Mackenzie Mountain Non-resident and Non-resident Alien Hunter Harvest Summary 2012

Nicholas C. Larter and Danny G. Allaire

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ABSTRACT

Each of the eight licenced outfitters and Renewable Resource Officers with the Sahtu and Dehcho Environment and Natural Resources (ENR) regional offices collected data on big game harvested in the Mackenzie Mountains during the 2012 hunting season. Harvest data and observations of wildlife from non-resident and non-resident alien hunters (collectively called 'non-resident' for this report) were recorded. For 2012, 396 hunters bought non-resident licences. This is higher than the average 365 (range 321-407) sold to non-resident hunters from 1991-2012, but similar to sales over the past eight years. Hunters (n=301) from outside Canada (non-resident aliens) were primarily from the USA (n=234) and comprised 59% of the outfitted hunters; 12, 12, and 7 hunters were from Germany, Mexico, and Spain respectively. There were 95 (24%) Canadian hunters, whose residency was from outside the Northwest Territories (NWT), of these 84 were from Alberta (AB) or British Columbia (BC). Of the 396 non-resident licence holders, 361 came to the NWT and most spent at least some time hunting. Two-hundred and seventy tags were purchased for Dall's sheep; 207 rams were harvested (including seven by resident hunters). The average annual ram harvest over the past 22 years was 197. The mean (±SD) age of harvested rams was 10.9±1.6 years, equalling the highest average age since records have been kept (1967), and the 25th consecutive year the average age of harvested rams from the Mackenzie Mountains has been ≥9.5 years. The average right horn length was 89.9 cm, with the percent of broomed horns considerably lower than average. Hunters reported seeing more legal rams (horns at least ¾ curl) than rams with horns <¾ curl during their hunts,

average eight legal rams/hunt. Based upon hunter observations we estimated 53.9 lambs and 86.9 rams per 100 ewes, respectively. In 2012, 300 tags were purchased for northern mountain caribou, the second highest since reporting started in 1991. The harvest of 168 bull caribou was higher than the average of 159 (range 117-191) from the past 22 years. Hunters observed an estimated 39.5 caribou calves and 46.5 bulls per 100 adult female caribou, respectively. One hundred and fifteen tags were purchased for moose, the third highest recorded. The harvest of 85 bull moose in 2012 is the greatest since reporting started in 1991. Hunters observed an estimated 32.7 moose calves and 87.5 bulls per 100 adult female moose, respectively. The number of calves per 100 adult females is higher than the average 30:100 recorded since 1995. Since 2004 the ratio has been $\geq$30:100. The 42 tags purchased in 2012 for mountain goats was similar to the average of 43 tags purchased for last eight years. Twelve goats (all males) were harvested, a harvest similar to that reported in 2006 and 2010. The mean age, determined by horn annuli of 12 harvested goats, was 7.1 years (range 3.5-14.5 years); three goats were >10 years old. Hunters observed an estimated 51.8 goat kids and 71.9 billies per 100 adult nannies. Twenty-four wolves were harvested from 292 tags purchased, including five harvested during hunts in March 2013, a time outside of the usual hunting season in the mountains. The harvest of 24 wolves in 2012 is the greatest since reporting started in 1991. From 1991-2011 the mean annual wolf harvest was 15. Hunters observed 253 wolves in 2012 (range 142-317 observed 1995-2011). No wolverines were harvested from 153 tags purchased in 2012. Hunters observed 29 wolverines in total including observations of three pairs of animals. No black bears were harvested from 16 tags purchased. Only five black bears have been

harvested in the Mackenzie Mountains since 1991. Black bears were observed north of 64°N latitude. There has been no grizzly bear hunting season for non-residents since 1982. One nuisance grizzly bear was killed this year. Hunter satisfaction remains high; 98% of respondents (n=212) rated their experience as either excellent (93%) or very good (5%). The high quality hunting experience, the abundance of wildlife in the Mackenzie Mountains (both game and predators), and the impressive management and stewardship of the land were specifically commented on. Repeat clients (28% of respondents) had returned for a 2nd to 20th hunt, and 93% of respondents indicated they would like to return in future years. Disappointingly, we received only 60% of the voluntary hunter observation forms, returning to pre-2004 levels. However, the new reporting system we designed with the Association of Mackenzie Mountain Outfitters (AMMO) for summarizing wild game meat records continues to work extremely well. This is the second year in a row we have been able to summarize information about meat distribution for all eight outfitters. We estimated a minimum of least 24,961 kg (54,915 lbs.) of wild game meat, mostly moose and mountain caribou, was distributed locally in 2012. Replacement cost of meat from local northern retailers is estimated conservatively at $624,025 using $25/kg average replacement cost. The distribution of wild meat by outfitters to the community of Nahanni Butte was timely as the community was rebuilding from a June flood that had destroyed all food supplies. Although the boundaries of Nahanni National Park Reserve (NNPR) were substantially expanded in 2009, affecting outfitting zones D/OT/01, D/OT/02, and S/OT/03, until negotiations between these outfitters and Parks Canada are completed, ENR will continue to issue

licences, tags, and export permits for harvesting big game by these three outfitters in their zones.

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INTRODUCTION

General Background

The 140,000 km^2 (54,000 mi^2; 34.6 million acres) area of the Mackenzie Mountains in the western Northwest Territories (NWT) was first opened to non-subsistence hunters in 1965 (Simmons 1968). Since then, the Mackenzie Mountains have become world-renowned for providing a high quality wilderness hunting experience, (www.spectacularnwt.com/whattodo/hunting/themackenziemountains, www.hunting report.com, Veitch and Simmons 1999), particularly for Dall's sheep and more recently moose. In return, non-resident hunters and outfitters in the Mackenzie Mountains provide about $2.5 million annually to individuals, businesses, and governments in the NWT (Harold Grinde, personal communication). The outfitted hunting industry in the Mackenzie Mountains also provides employment for 150-170 outfitters, guides, pilots, camp cooks, camp helpers, and horse wranglers (Werner Aschbacher, personal communication). In addition, fresh meat from many harvested animals is provided to a number of local communities including Tulita, Fort Good Hope, and Norman Wells in the Sahtu and Wrigley, Nahanni Butte, Fort Liard and Fort Simpson in the Dehcho. This meat is distributed among local elders and residents and to health/long term care facilities. The estimated annual replacement value of this meat has ranged from *ca.* $60,000-625,000.

Eight outfitters are currently licenced by the Government of the Northwest Territories (GNWT) to provide big game outfitting services within the Mackenzie Mountains (Figure 1, Appendix A). No hunting is permitted within the original boundaries of NNPR (Figures 1, 2) except for subsistence harvest by NWT General Hunting

Licence (GHL) holders. Under the terms of the NWT *Wildlife Act*, each licenced outfitter has the exclusive privilege of providing services within their zone, which enhances the outfitters' ability to practice sustainable harvest through annual allocation of the harvest effort.

The hunting licence year in the NWT runs from 01 July to 30 June and those who desire to hunt big game within the NWT must annually obtain a big game hunting licence and must be at least 16 years old (Environment and Natural Resources 2012). There are four classes of licenced big game hunters in the NWT:

1) *General:* subsistence harvesters, primarily Aboriginal people.

2) *Resident:* Canadian citizens or landed immigrants who have been living in the NWT for at least two consecutive years prior to application for the licence.

3) *Non-resident:* Canadian citizens or landed immigrants who live outside the NWT, or have not resided in the NWT for a full two years prior to application for the licence.

4) *Non-resident Alien:* an individual who is neither a NWT resident nor a non-resident.

Both non-resident and non-resident alien hunters must use the services of an outfitter and must be accompanied by a licenced guide at all times while hunting big game. For simplification in this report, we call both non-resident and non-resident alien hunting licence holders 'non-residents' and combine their harvest statistics. The data from seven resident hunters, who harvested Dall's sheep in the Mackenzie Mountains without a guide, have been included in the number of sheep harvested and the age and horn length measurements in this report as indicated.

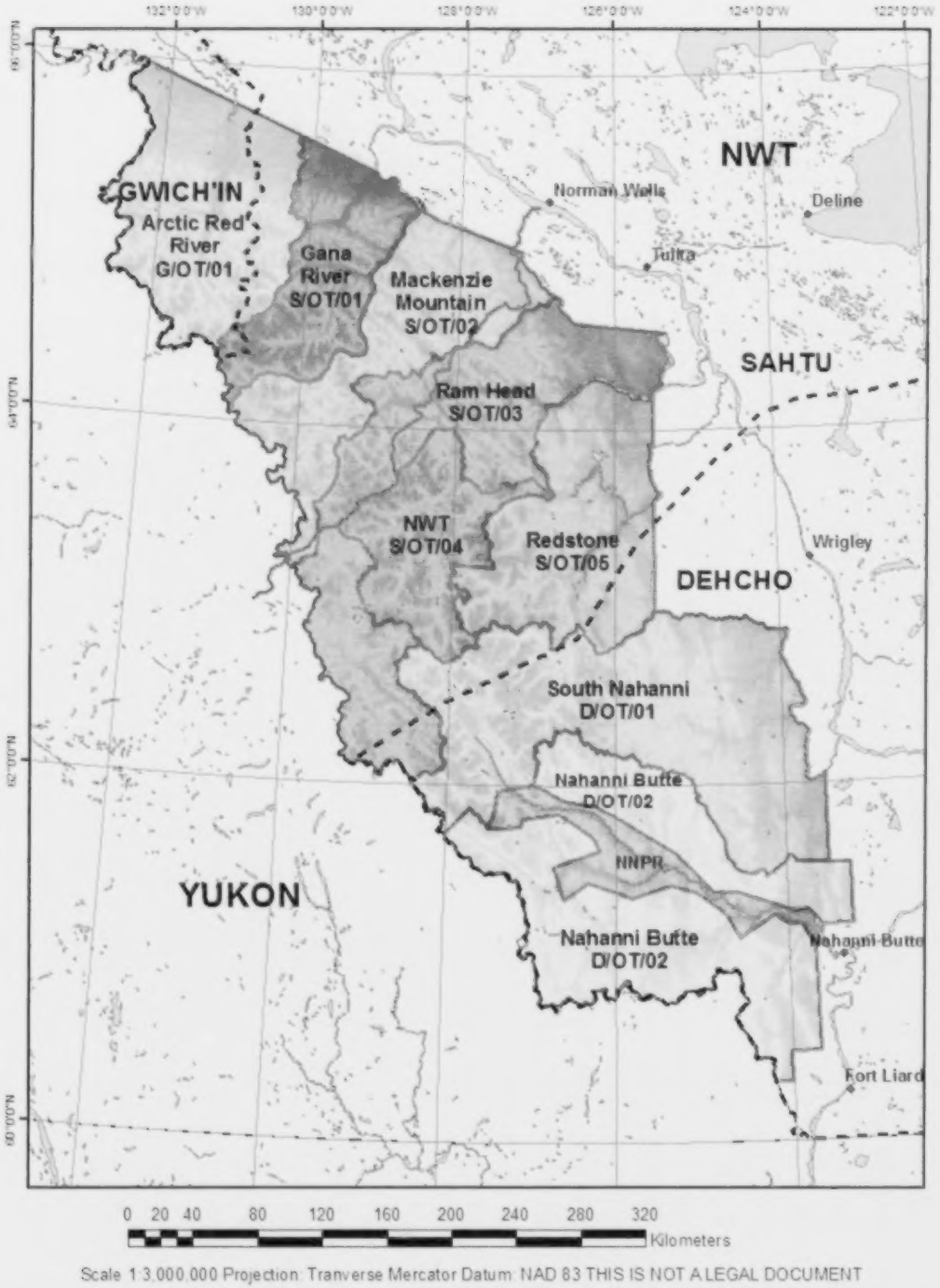

Figure 1: Outfitting zones and land claim areas (dotted lines) of the Mackenzie Mountains, Northwest Territories, with Nahanni National Park Reserve (NNPR) original boundary, prior to 2009 expansion, indicated.

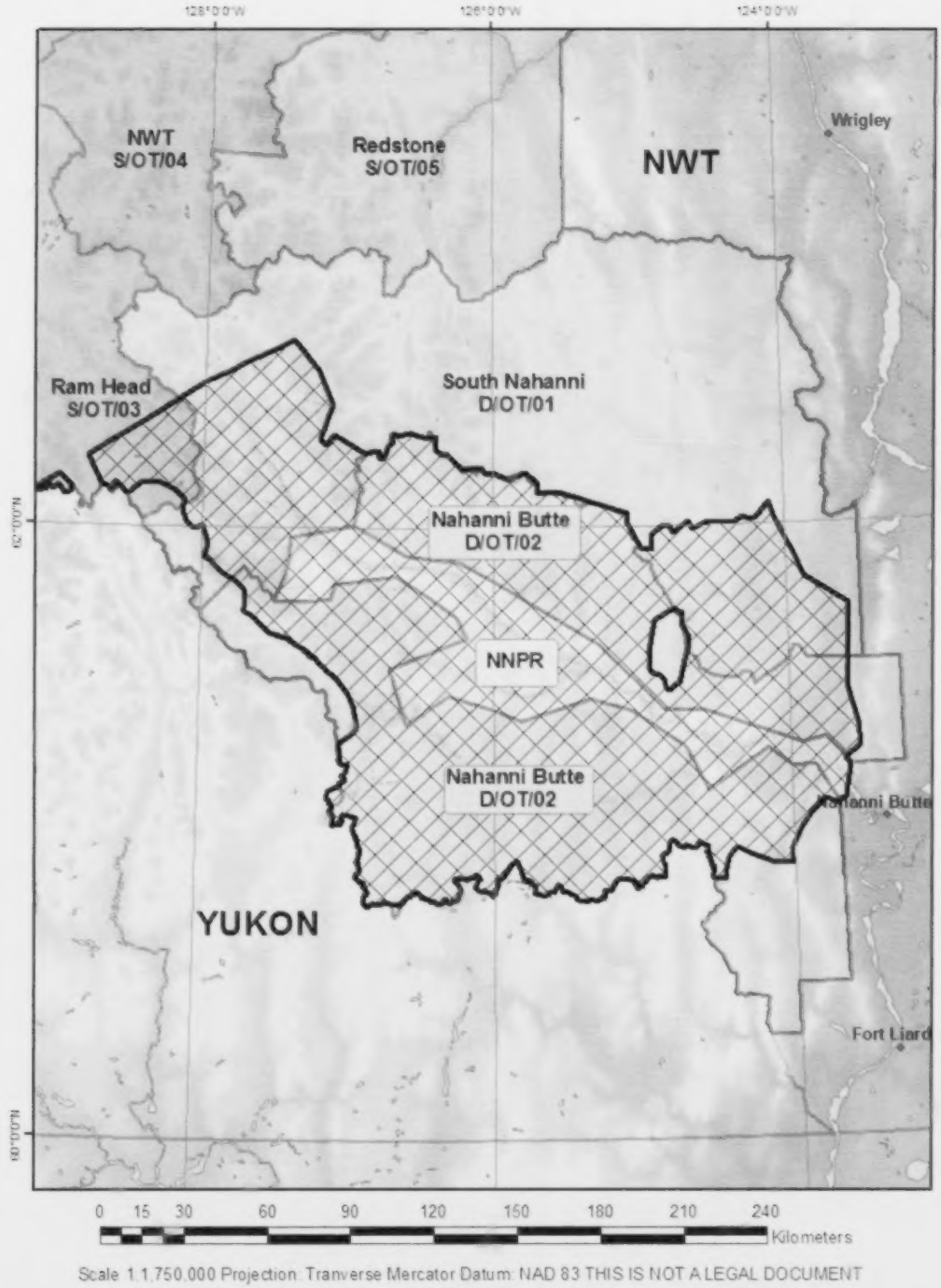

Figure 2: The original boundary of NNPR, in white, with the expanded boundary (9 June 2009) indicated by the checkered polygon.

Individual non-resident hunters are annually restricted to one each of the following big game species (Appendix B): Dall's sheep (male with at least ¾ curl horns), northern mountain woodland caribou (either sex), moose (either sex), mountain goat (either sex), wolf (either sex)[1], wolverine (either sex), and black bear (adult not accompanied by cub(s)). Although non-resident hunters are allowed to hunt female moose and caribou they prefer to hunt males for their trophy antlers and the harvest is exclusively males. Non-resident hunting for grizzly bears was closed in 1982 as a result of concerns about over-harvest (Miller et al. 1982, Latour and MacLean 1994). There are currently no restrictions on the total number of each big game species that an outfitter can take within the zone for which they are licenced.

Wildlife management within the Mackenzie Mountains is the responsibility of a variety of government agencies and boards set up as a result of comprehensive land claim agreements. The NNPR (4,766 km^2 original pre-2009 boundary) in the south Mackenzie Mountains is managed by Parks Canada – an agency of the Canadian federal government. Under the terms of the *Sahtu Dene and Métis Comprehensive Land Claim Agreement* (signed in 1993) and the *Gwich'in Comprehensive Land Claim Agreement* (signed in 1992), the main instrument of wildlife management within the two settlement areas lies with the Sahtu Renewable Resources Board (SRRB) and the Gwich'in Renewable Resources Board (GRRB), respectively. Approximately 68,000 km^2 of the central and northern Mackenzie Mountains are within the Sahtu Settlement Area and 8,300 km^2 are within the Gwich'in Settlement Area, which encompass the extreme

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[1]In the Sahtu region, non-resident hunters and non-resident alien hunters are allowed to hunt two wolves from 1 August - 15 April.

north end of the range (Figure 1). However, the GNWT maintains ultimate jurisdiction for management of wildlife and wildlife habitat within each of the claim areas. ENR is responsible for licencing outfitters, guides, and hunters and for annually monitoring non-resident big game harvest in the Mackenzie Mountains.

Each year ENR, under provisions in the NWT's *Wildlife Business Regulations*, requires outfitters to submit an outfitter return on a client hunter success form for each person that purchased a NWT non-resident big game hunting licence (Figure 3). These are known as outfitter return forms and they must be submitted whether or not a client actually hunted, and whether or not any game was harvested. The outfitter return forms allow us to quantify harvest by non-resident hunters to help biologists with the GRRB, SRRB, and ENR to ensure that the harvest of each species is within sustainable limits.

In 1995, the then Department of Resources, Wildlife and Economic Development (RWED), requested that all non-resident hunters also fill out a voluntary questionnaire. The questionnaire has evolved through the years based upon suggestions from outfitters, their clients, and government staff. Different questions pertaining to wildlife observations, the quality of the hunting experience, the quality of services related to hunter travel, and specific topics for hunter comment have come and gone. However, one key component of the questionnaire that has remained constant pertains to reporting the different types and numbers of wildlife species seen during their hunts. These data have been recorded and the questionnaire forms have been referred to as hunter observation forms in this report (Figure 4). These data provide valuable time series of observations and have been used in assessing mountain caribou herd status (Larter 2012a).

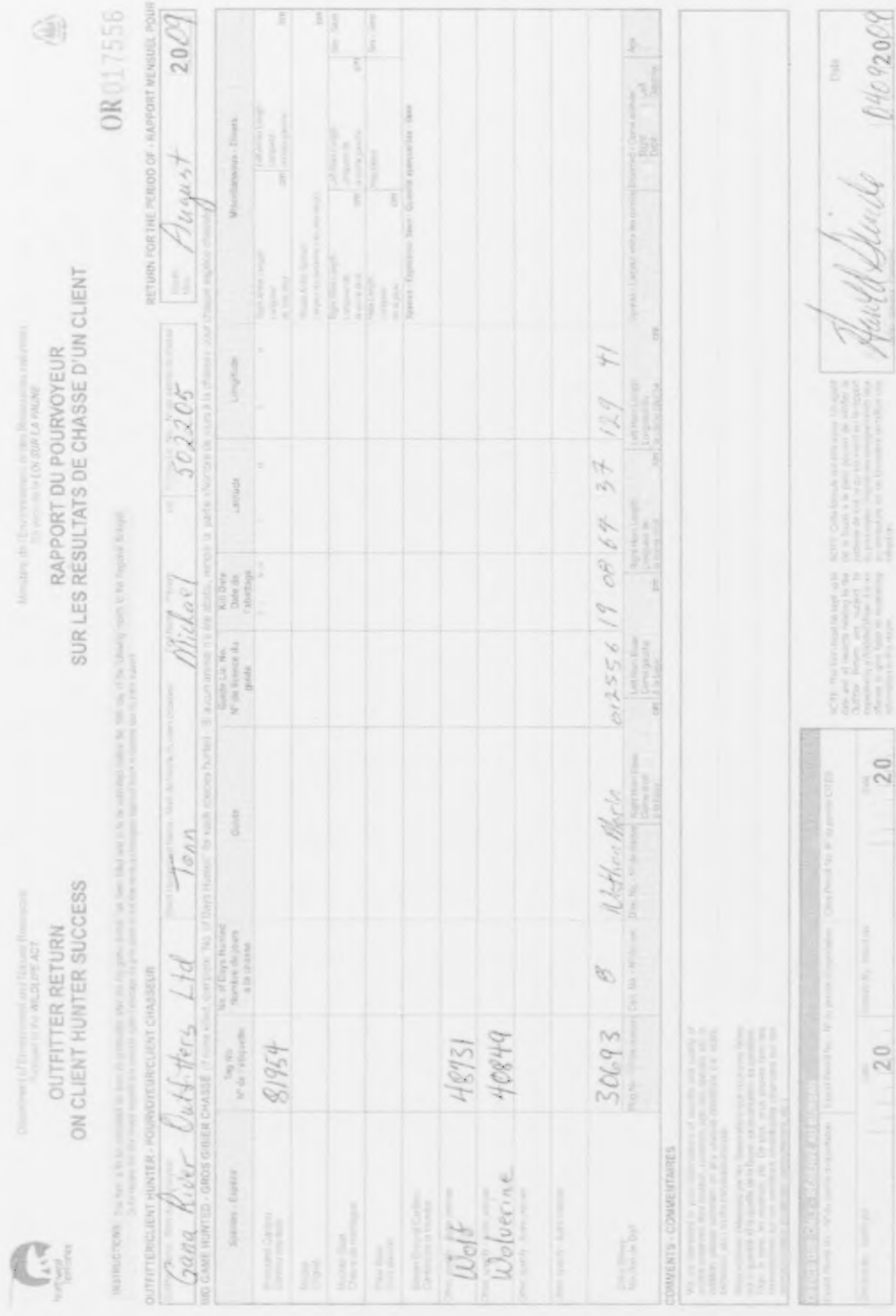

Figure 3: Example of a completed outfitter return on client hunter success form.

MACKENZIE MOUTAINS, NORTHWEST TERRITORIES
HUNTER WILDLIFE OBSERVATION REPORT – 2007

Dear Hunter: The Department of Environment and Natural Resources request your kind assistance with completing this questionnaire about your NWT hunting experience, in order to assist us with the management of Mackenzie Mountain big game populations. All the requested information is completely voluntary, but your providing it to us is most appreciated.

HUNTER INFORMATION

Last Name	First Name and Initials	
CLIFFORD	GREGORY P.	
Address: number and street, box number	**Town, City**	**Province, State, Country**
14 SAGE ROAD	LANDER	WYOMING USA

Hunting License # NL 715052 Outfitter Zone: G1 07 101 Outfitter: ARCTIC RED RIVER

Start Date of Hunt 7/15 2007 End Date of Hunt 7/24 2007 Observations Made Over 10 Days

ESTIMATED NUMBER OF DALL'S SHEEP SEEN			
¾ and Full Curl Rams	Less than ¾ Curl Rams	Ewes	Lambs
25	46	24	17

ESTIMATED NUMBER OF WOODLAND CARIBOU SEEN		
Bulls	Cows	Calves
2	1	1

ESTIMATED NUMBER OF MOOSE SEEN		
Bulls	Cows	Calves
0	0	0

ESTIMATED NUMBER OF MOUNTAIN GOAT SEEN			
Billys	Nannys	Kids	Unknown Age
0	0	0	0

Other Species						
	Wolf	Wolverine	Black Bear		Grizzly Bear	
			Adult	Cub	Adult	Cub
Number(s) Seen	3	0	0	0	1	0

How would you rate you overall hunting experience in the Mackenzie Mountains?
Excellent X Very Good ____ Good ____ Fair ____ Poor ____

How many times have you hunted in the Mackenzie Mountains, **including** this year's hunt? 2

Do you plan to return to hunt in the Mackenzie Mountains again? Yes X No ____

COMMENTS: Excellent River / outfitter

Thank You! Please give this form to the Officer or Clerk when you are exporting your trophies, or to the guide/outfitter with whom you hunted. We would appreciate receiving this form whether of not you harvested an animal(s).

Figure 4: Example of a fully completed hunter observation report form.

This is the eighteenth consecutive year that a summary of the data collected by ENR on non-resident hunters in the Mackenzie Mountains has been made. In the text of this document, data for 1995 are found in Veitch and Popko (1996), for 1996 in Veitch and Popko (1997), for 1997 in Veitch and Simmons (1998), for 1998 in Veitch et al. 2000b, for 1999 and 2000 in Veitch and Simmons (2000, 2002, respectively), for 2001 by Veitch and Simmons (unpublished data), for 2002-2011 in Larter and Allaire (2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012 respectively). Additionally, Latour and MacLean (1994) summarized data for 1979 to 1990. This report compiles the harvest data collected during the 2012 hunting season and compares it with available data collected since 1995, and earlier when available.

Nahanni National Park Reserve Expansion

Nahanni National Park Reserve (NNPR), encompassing an area of 4,766 km^2 in the southern Mackenzie Mountains, was originalliy established in 1972, after Prime Minister Pierre Elloit Trudeau canoed down the Nahanni River. The Park was in "reserve" status pending settlement of outstanding Aboriginal land claims in the region, which remain ongoing. On 9 June, 2009, the Canadian government, with Dehcho First Nations, announced legislation increasing the area of NNPR to *ca.* 30,000 km^2 (11,583 mi^2). This newly enlarged boundary includes 91% of the greater Nahanni ecosystem and most of the South Nahanni River watershed in the Dehcho region (www.pc.gc.ca).

The enlarged boundary also overlaps three of the eight outfitting zones which were established in the Mackenzie Mountains in 1965: Ram Head Outfitters (S/OT/03), South Nahanni Outfitters (D/OT/01) and Nahanni Butte Outfitters (D/OT/02). Of the total area of their outfitting zones, 4.7% of the Ramhead zone, 27.2% of the South Nahanni

zone and 79.4% of the Nahanni Butte zone fall within the newly expanded boundary of the NNPR (Table 1).

Table 1: The area (km²) and % of the outfitting zone that lie within the 2009 expanded boundary of NNPR.

Outfitter	Area of outfitting zone	Area of outfitting zone within new NNPR	% of zone within new NNPR
Ram Head Outfitters	19,734.82 km²	921.27 km²	4.7 %
South Nahanni Outfitters	25,024.16 km²	6,811.10 km²	27.2 %
Nahanni Butte Outfitters	21,962.30 km²	17,450.66 km²	79.4 %

Parks Canada is currently negotiating with the operators of these outfitting zones in regards to third party interests and land transfer. A tentative ten year time line from the date of the announced expanded boundary has been proposed. Until negotiations have been completed, and the GNWT has been advised of such, it remains business as usual for these outfitters; ENR will continue to issue licences, tags, and export permits for harvesting by these three outfitters in their zones.

The Prairie Creek mine, established in 1966, now falls completely within the newly expanded boundary of NNPR. However, the mine and an area of *ca.* 300 km^2 surrounding the site were specifically excluded from NNPR so that the mine owned by Canadian Zinc was assured of its third party rights to operate and access the mine site. A new bill amending the National Parks Act solely for NNPR was required to assure these third party rights (www.canadianzinc.com).

Share Sale Agreement of Outfitting Zone

Arctic Red River Outfitters (ARRO, G/OT/01) completed a share sale agreement during 2009. ARRO obtained a surrender of rights of first refusal from the Gwich'in

Tribal Council as part of the sale requirements. ARRO operates in two settled land claim areas; 78% falls within the Gwich'in land claim area and 22% within the Sahtu land claim area (Figure 1). Rights of first refusal, however, cannot be provided to two different land claim organizations. With Acho Dene Koe (ADK) seeking their own land claim separately from the Dehcho Process, now six of the eight Mackenzie Mountain outfitting zones cover more than one land claim area (Table 2). If there is a sale of an outfitting licence, rights of first refusal must be done in accordance with the land claim agreement for the area where the licence is held. ENR is planning to amend regulations in the future to realign outfitting zones with land claim boundaries.

Table 2: The areas (km^2) and % of each outfitting zone that fall within different land claim (Dehcho, ADK, Sahtu and Gwich'in) areas. Bold indicates zones found exclusively within one land claim area.

Outfitter Zone	Area (km^2)	Dehcho (km^2)	%	ADK (km^2)	%	Sahtu (km^2)	%	Gwich'in (km^2)	%
S/OT/01	9,273	n/a	0.0	n/a	0.0	9,029	97.4	244	2.6
S/OT/03	19,735	1,247	6.3	n/a	0.0	18,488	93.7	n/a	0.0
S/OT/05	14,014	1,810	12.9	n/a	0.0	12,204	87.1	n/a	0.0
S/OT/02	**12,721**	n/a	0.0	**n/a**	0.0	**12,721**	**100.0**	n/a	0.0
D/OT/01	25,024	22,386	89.5	n/a	0.0	2,639	10.5	n/a	0.0
S/OT/04	**8,126**	n/a	0.0	**n/a**	0.0	**8,126**	**100.0**	n/a	0.0
D/OT/02	21,962	21,962	74.2	5,659	25.8	n/a	0.0	n/a	0.0

METHODS

Prior to the start of the 2012 hunting season, each outfitter in the Mackenzie Mountains received sufficient copies of the outfitter return and hunter observation forms for all their clients for the year. The *Wildlife Business Regulations* requires outfitter return forms to be returned by the tenth day of the month following the month of the hunt – e.g. for a hunter that was in the field in July, a form must be submitted by the 10th of August. Those forms were submitted to the senior biologist in the Dehcho or Sahtu region, whether or not a client actually hunted and whether or not harvest occurred. In co-operation with ENR Renewable Resource Officers and the outfitters, persistent attempts were made to obtain outfitter return forms for every non-resident that held a big game hunting licence through a Mackenzie Mountain outfitter in 2012.

Data from both the outfitter return forms and hunter observation forms were entered into Microsoft Excel (Microsoft Corporation 2010) spreadsheets. Data were cross-checked with the records of sequentially numbered, unique identifier plugs inserted in the horns of legally harvested rams found in the Licence Information System-IntraNet (LISIN) data management system maintained by ENR offices across the NWT, and also with GNWT wildlife export permit forms, to ensure that all data were verified and the spreadsheets contained all appropriate available data required for analyses.

We distributed new hunter observation forms in 2012 for consistency and recorded all observations directly from these hunter observation forms. If we did not receive a hunter observation form, but wildlife observation data were recorded on the outfitter return form, we used these wildlife observation data. If observation information differed between the hunter observation form and the outfitter return form for the same client, we used the

data from the hunter observation form. Occasionally we received identical observation data from forms of different hunters. These hunters had the same guides and lengths of hunts, and obviously had hunted together. We recorded forms with data that had been provided, but for the wildlife observation analyses only one set of observations was used.

All descriptive statistical analyses were performed using Microsoft Excel. We present means ± standard deviation (SD). Some additional statistical analyses were performed using Minitab 7.2 software (Minitab Inc. 1989).

RESULTS AND DISCUSSION

Hunters

Big game hunting licences for the Mackenzie Mountains were bought by 396 non-resident hunters in 2012 (Table 3). This is up from the annual average of 365 licences sold between 1991-2012 (range 321-407), but similar to licence sales over the past eight years (Figure 5, Appendix F). Of those 396 hunters, 361 came to the NWT and spent some time hunting. The remaining 35 either cancelled their hunts, decided not to hunt for themselves but participated with other hunters they knew, or decided not to hunt due to unforeseen complications after arriving in the NWT. Twenty of these 35 were guides. Guides often purchase licences every year but rarely have the opportunity to hunt themselves.

In 2012, licence sales to non-resident Canadians (n=95) and residents of countries other than the United States (n=67) represented 24% and 17%, respectively, of the number of licences sold (Table 3, Figure 6). The percentage of hunters from the United States has decreased since 2005. Conversely, the percentage of hunters from elsewhere in the Americas and Europe has increased. The change in ownership of South Nahanni Outfitters (D/OT/01) directly resulted in an increased number of European and South American clients. We presume the continued strength of the Canadian dollar is a factor in this change. Guided hunts are marketed in American dollars. A weaker American dollar against foreign currencies makes hunts more attractive to foreign clients, and outfitters realize the need to diversify their clientelle base (Jim Lancaster, personal communication).

Table 3: Province, state and/or country of origin of the 396 non-residents who purchased licences for hunting in the Mackenzie Mountains, 2012.

Canada		United States		Europe		Other	
Yukon	**3**	Eastern States[1]	**95**	Germany	**12**	Mexico	**12**
British Columbia	**29**			Spain	**7**	Russia	**6**
Alberta	**55**	Western States[2]	**139**	Sweden	**5**	Lebanon	**5**
Saskatchewan	**1**			Austria	**4**	Australia	**3**
Manitoba	**1**			France	**3**	New Zealand	**2**
Ontario/ Quebec	**6**			Norway	**3**	Turkey	**2**
Atlantic Provinces	**0**			Belgium	**1**	Singapore	**1**
				Czech Republic	**1**		
Total	**95**		**234**		**36**		**31**

[1] AL, AR, CT, DE, FL, GA, IL, IN, IA, KY, LA, ME, MD, MA, MI, MN, MS, MO, NH, NJ, NY, NC, OH, PA, RI, SC, TN, VT, VA, WV, WI

[2] AK, AZ, CA, CO, HI, ID, KS, MT, NE, NV, NM, ND, OK, OR, SD, TX, UT, WA, WY

Table 4: Percent of Mackenzie Mountain outfitter and non-resident hunter forms submitted, 1995-2012.

Form Type	2012	2011	2010	2009	2008	2007	2006	2005	2004
Outfitter Return (mandatory)	99	99	98	99	99	98	99	100	99
Hunter Observation (voluntary)	60	62	60	62	71	65	64	65	74

Form Type	2003	2002	2001	2000	1999	1998	1997	1996	1995
Outfitter Return (mandatory)	98	95	92	96	96	97	98	100	98
Hunter Observation (voluntary)	60	59	57	53	51	60	50	71	80

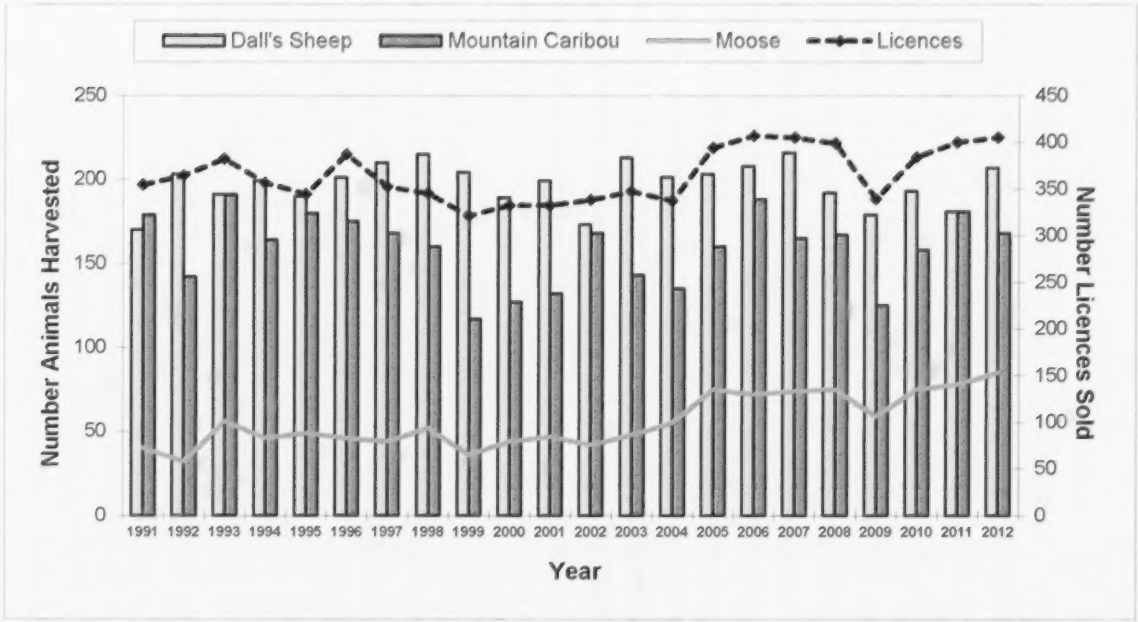

Figure 5: The number of Dall's sheep, mountain caribou, and moose harvested in the Mackenzie Mountains by non-resident hunters, and the number of non-resident licences sold during 1991-2012.

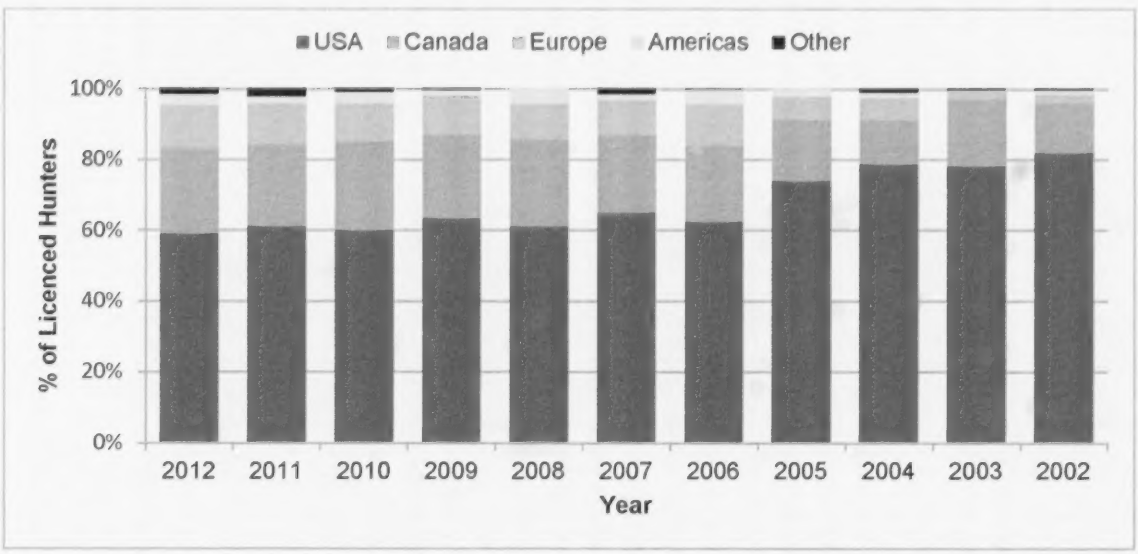

Figure 6: The geographical areas of origin of hunters purchasing licences (in %) to hunt in the Mackenzie Mountains from 2002-2012.

Normally, guided hunting in the Mackenzie Mountains occurs from July to October, however successful winter hunting of wolves occurred for the fourth consecutive season in zone S/OT/01. Five wolves were harvested in the spring of 2013.

We received all but four mandatory outfitter return forms for the 396 people that purchased non-resident licences. Voluntary hunter observation report forms were received from 216 (60%) of the 361 that did at least some hunting in 2012 (Table 4). We still struggle to get much more than a 60% return on these forms, which is disappointing since there was a consensus by outfitters at the 2003 annual general meeting of the AMMO to increase the return of voluntary hunter observation forms. Although most outfitters endeavour to have clients complete and submit these forms, we received only 60% of the 38 forms from S/OT/02, 40% of the 22 forms from S/OT/04, and 8% of 47 forms from S/OT/03. The limited returns from outfitting zones with fairly large clientele is of concern because in order to generalize observations over the entire Mackenzie Mountains, representative observations are required from all outfitting zones; two of these outfitter zones encompass the greatest range in latitude in the Mackenzie Mountains (Figure 1). See Figure 4 as an example of a fully completed hunter observation form.

It is obvious that non-resident hunters immensely enjoy their hunting experience in the Mackenzie Mountains (Table 5). In 2012, 98% of respondents rated their experience as either excellent (93%) or very good (5%). Not only do voluntary client comments make specific mention of the high quality of hunts (n=112), and the abundance/quality of animals (n=80; Appendices C, D), but many comments make reference to (1) the professional and world class experience with their chosen guides,

(2) the abundance of a wide variety of game species and predators, (3) the apparent health and condition of the game animals, (4) the pristine and scenic environment of the Mackenzie Mountains, and (5) compliments on the management and stewardship of the land.

Table 5: Satisfaction ratings for non-resident hunters (including non-hunting guides) in the Mackenzie Mountains, 1996-2012.

Rating	2012	2011	2010	2009	2008	2007	2006	2005
Number of Hunters Reporting	212	210	193	191	239	239	230	256
Excellent (%)	93	90	88	86	85	81	80	90
Very Good (%)	5	6	10	12	10	12	16	7
Good (%)	2	4	1	2	4	5	3	2
Fair (%)	0	0	1	0	1	2	1	1
Poor (%)	0	0	0	0	0	0	0	0

Rating	2004	2003	2002	2001	2000	1999	1998	1997	1996
Number of Hunters Reporting	229	191	193	191	158	157	202	144	224
Excellent (%)	84	82	82	75	76	73	80	78	77
Very Good (%)	10	15	15	16	17	20	17	17	17
Good (%)	5	3	3	6	6	5	2	3	2
Fair (%)	0	0	0	1	0	1	1	1	3
Poor (%)	1	0	0	1	1	2	0	1	1

Comments about grizzly bears have been common since the start of the voluntary hunter observation forms in 1995; their abundance, problems created around camps and kills, and the lack of, and need for, a grizzly hunting season being consistent themes. This year was no different (Appendices C, D). In 2000 we started getting comments about high wolf numbers, this has continued with a few comments during the 2012 hunting season. This was the first year since the announced expansion of NNPR

on 9 June 2009 that we did not receive comments on park expansion. In previous years many questioned the need for such a large expansion, especially in an area that had been so respectfully managed on a sustainable basis. There were also comments about making a provision for hunting to continue in the expanded area; GHL holders can hunt in the area. Outfitters reported seeing noticeably more porcupines this year than in previous years. Porcupines were often observed in sub-alpine areas.

It was the first time hunting in the Mackenzie Mountains for 154 of 212 (73%) respondents (including non-hunting guides). The 59 repeat hunters had hunted from 1-20 times previously. Of 212 respondents (including non-hunting guides) 93% indicated they would like to return to the Mackenzie Mountains to hunt in the future.

Prior to the 2009 hunting season ENR worked with AMMO to devise a better reporting system for wild game meat use and distribution. What resulted was a supplementary summary meat record form that ENR provided to each outfitter. The new form could be used by itself or with the AMMO meat forms which were voluntarily submitted to ENR. Unfortunately, in the past, AMMO meat forms from outfitters in the Sahtu did not always get turned in and/or forwarded to the Dehcho ENR office. Some outfitters kept the meat forms for their own records in order to have them available for inspection (Kelly Hougen, personal communication). Both forms record the amount of meat (Dall's sheep, northern mountain caribou, moose, and mountain goat) taken from harvested animals and how the meat was used and/or distributed. This year, in addition to the 93 AMMO meat forms submitted, we received summary forms from all eight outfitters. This is the second year in a row we received records of meat distribution from all eight outfitters. ENR will continue to provide supplementry meat forms to all outfitters.

The distribution of wild game meat by outfitters is an important and greatly appreciated local benefit but can often be a topic of heated local debate. Meat is used in outfitter camps by guides and clients, is taken out with clients, and is provided to local communities. We believe that the information from summary meat record forms provides a better overall picture of the amount of wild game meat being distributed by the outfitters. Generally the majority of meat from harvested Dall's sheep and mountain goats is used in outfitter camps. Nevertheless, at least 2,227 kg (4,899 lbs.) from 207 harvested Dall's sheep and 288 kg (634 lbs.) from 12 harvested mountain goats, was distributed locally. Northern mountain caribou and moose meat is also used in outfitter camps, but harvested mountain caribou and moose make up a large portion of the wild game meat that is distributed locally: at least 8,555 kg (18,822 lbs.) from 168 northern mountain caribou and at least 13,891 kg (30,560 lbs.) from 85 moose. If we use a relatively conservative $25/kg as the replacement cost for meat from local northern retailers, then some $624,025 of meat was distributed locally in 2012.

In June 2012, the community of Nahanni Butte flooded and meat in all freezers was lost. Nahanni Butte outfitters provided wild meat to residents throughout the hunting season and went out of their way to ensure that by the end of the hunting season all available wild meat was distributed to residents of the community. Acting Chief Jayne Konisenta (personal communication) stated that the outfitters provide wild game to residents of Nahanni Butte every year and that they were especially grateful for receiving the meat this year as the community rebuilt from the flood.

Dall's Sheep (*Ovis dalli*)

Dall's sheep is one of the most desired species sought by non-resident hunters in the Mackenzie Mountains. Tags to hunt Dall's sheep were purchased by 270 (68%) non-resident hunters in 2012. This is similar to the average number of tags purchased in the past 18 years (Table 8). At least 77% of sheep tag holders (including seven resident hunters) pursued Dall's sheep and harvested 207 rams, more than the average 197 sheep harvested in the Mackenzie Mountains (1991-2011) (Figure 5, Appendix F). The mean (±SD) length of a sheep hunt was 4.0±3.0 days, similar to hunt lengths from 1997 to 2011 (Table 6), but less than the 5.3 day average from 1979-1990 (Latour and MacLean 1994). Outfitted hunts in the Mackenzie Mountains are generally booked for ten days; when hunters fill their sheep tag, any remaining time is typically spent in pursuit of other big game species for which tags are held, or in hunting small game. The number of hunters taking multispecies hunts has increased in recent years (Jim Lancaster, personal communication and Wener Aschbacher, personal communication).

Harvest by non-residents comprises at least 90% of the total annual harvest of Dall's sheep in the Mackenzie Mountains and takes only 0.9 to 1.6% of the estimated 14,000 to 26,000 Dall's sheep in the Mackenzie Mountains (Veitch et al. 2000a). Therefore, the current non-resident harvest level appears well within sustainable limits, provided that hunting pressure is geographically distributed across each of the zones. In the Yukon Territory - where harvest is managed by a full curl rule - thinhorn sheep managers have set the sustainable harvest at 4% of the non-lamb population (Yukon Renewable Resources 1996). In those areas of the Yukon where the management objective is to increase population size, harvest is limited to 2% of the total population.

There has been remarkable consistency in the mean outside contour length of the right horns from rams harvested by non-residents for the past 40 years (1972-2012), mean 89.0±1.6cm (SD) (Appendix E, Table 7), which is surprising given the increase in average age of harvested sheep during that same period. We expected to see more broomed or broken horn tips on older animals, since horn breakage generally occurs as a result of fights between rival males (Geist 1993).

In 2012, 205 of the 207 harvested rams were aged, 155 (76%) were ≥10-years-old. The mean age (±SD) of harvested rams was 10.9±1.6 years (range 7.5-15.5 years, Figure 7). This equals the highest average age of harvested rams recorded in the Mackenzie Mountains since records have been kept (1967) and the 25th consecutive year where the reported mean age of harvested rams was 9.5 years or older (Appendix E). Only 22% of left and 26% of right horns from plugged trophies were broomed. This is considerably lower than the 31% (left) and 32% (right) brooming average over the past 16 years.

The continued high age of harvested trophy sheep may be a result of harvest being spread out in time and space within hunting zones. Exclusivity of non-resident big game harvesting within each zone provides the opportunity for outfitters to harvest in different parts of their zone on a rotational basis and forgo hunting in some areas for two or three seasons. In recent years some outfitters have used helicopters to gain access into areas not accessible by horseback. These areas that have not been previously hunted, spread out the harvest in space and likely contribute to the continued high average age of harvested rams.

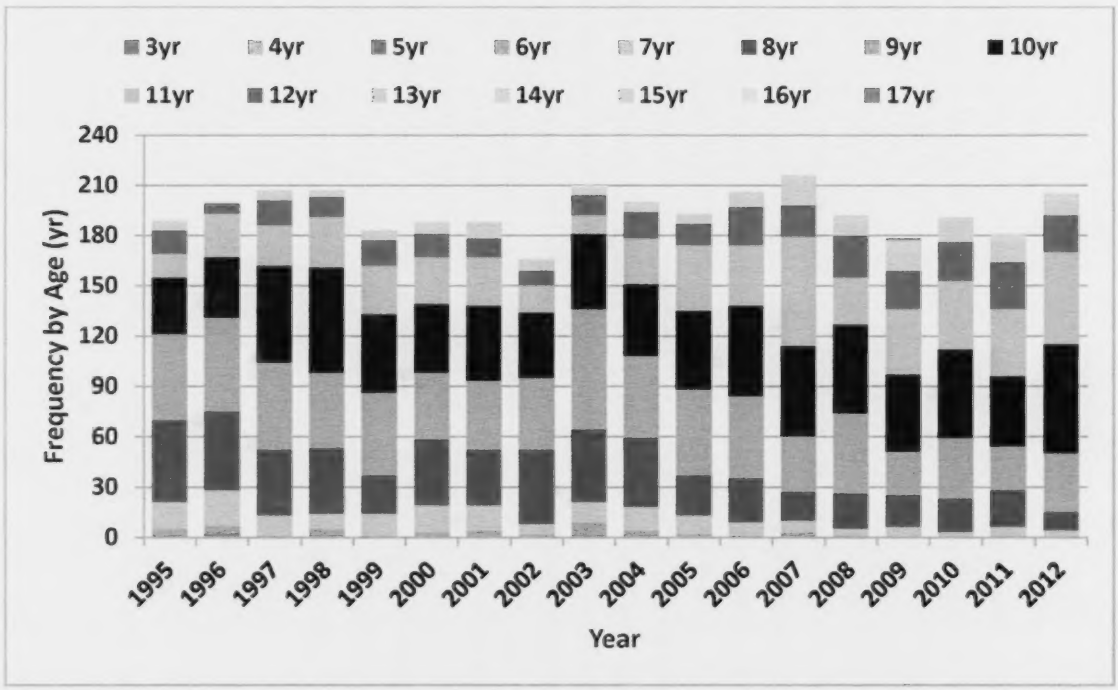

Figure 7: Age-structure of Dall's sheep ram harvest by non-resident and resident hunters in the Mackenzie Mountains, 1995-2012, based upon counting horn annuli.

We calculated an estimated 53.5 lambs per 100 ewes based upon hunter classifications of sheep observed during their hunts in 2012 (Table 9), similar to the average ratio of 55 lambs:100 ewes reported since 1995 (Appendix G). Ground-based surveys were conducted in July in two areas of the northern Sahtu region of the Mackenzie Mountains on an annual or semi-annual basis from 1997-2011. Average ratios of 65.3 and 57.3 lambs:100 ewes were reported (Veitch et al. unpublished data). For the Richardson Mountains of the northern Yukon and NWT, Nagy and Carey (2013) suggest an August ratio of 43 lambs:100 ewes would have allowed for their observed 10.5% average annual rate of increase from 1986-1991. Subsequent to a decline in this unhunted population from 1997-2003, Nagy et al. (unpublished data) reported 28 lambs per 100 'nursery sheep' in August 2003. Jorgenson (1992) summarized 17 years of

lamb:ewe classification data for a population of bighorn sheep in west-central Alberta and found a mean ratio of 43 lambs:100 ewes in September (range 25 to 54).

Table 6: Mean length, SD, and range (in days) of Dall's sheep hunts where at least one day was spent hunting from 1997-2012.

	2012	**2011**	**2010**	**2009**	**2008**	**2007**	**2006**	**2005**
Number of reports	207	173	179	179	192	216	214	190
Mean hunt length	4.0	4.0	4.0	3.9	3.7	4.1	4.1	4.1
SD	3.0	3.0	3.0	2.6	2.6	2.6	2.7	2.6
Range	1-14	1-11	1-13	1-10	1-14	1-13	1-12	1-14
	2004	**2003**	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**
Number of reports	167	189	174	176	198	201	224	216
Mean hunt length	4.0	3.8	4.7	4.8	4.6	4.7	4.4	4.3
SD	2.9	2.9	2.7	3.0	2.7	3.1	2.8	2.6
Range	1.17	1-12	1-12	1-15	1-15	1-16	1-15	1-12

Differences in adult sex ratios among populations may result from differences in hunting pressure, differences in survival of males and females from birth to adulthood, or both (Nichols and Bunnell 1999). However, since the ratio of rams to ewes is almost never equal in wild populations of mountain sheep, even where they are unhunted, it is clear that there is a different natural mortality rate for the two sexes. This difference was believed to be a result of injuries and stress accumulated by males during the breeding season (Geist 1971).

The 86 ram:100 ewe ratio estimated from hunter observations in 2012 is similar to the average 88 ram:100 ewe reported from 1995-2012 (Appendix G). Ground-based surveys were conducted in July in two areas of the northern Sahtu region of the

Mackenzie Mountains on an annual or semi-annual basis from 1997-2011. Average ratios of 63.4 and 58.1 rams:100 ewes were reported (Veitch et al. unpublished data).

Table 7: Measurements of Dall's sheep ram horns from sheep harvested by non-resident hunters in the Mackenzie Mountains, 2012.

	Left Horn Contour Length		Right Horn Contour Length		Left Horn Base Circumference		Right Horn Base Circumference		Tip To Tip Spread	
	cm	in	cm	in	cm	in	cm	in	cm	in
Mean	90.5	35.6	89.9	35.4	32.6	12.8	32.7	12.9	59.8	23.5
Std Dev	7.8	3.1	7.9	3.1	1.9	0.8	1.9	0.8	8.7	3.4
Maximum	110	43.3	105.5	41.5	37.6	14.8	38.0	15.0	83.0	32.7
Minimum	61.0	24.0	49.5	19.5	26.5	10.4	27.0	10.6	29.0	11.4

In the Yukon, mid- to late June annual aerial surveys to count and classify sheep from 1973 to 1998 reported a mean of 48 rams (range 28 to 74) per 100 'nursery sheep' (Jean Carey, Yukon Dept. of Renewable Resources, unpublished data). For the unhunted Richardson Mountains herd (YK-NWT), Nagy et al. (unpublished data) reported 41 rams per 100 'nursery sheep' in 2003 following a decline from peak population size in 1997. In Alaska, ram:ewe ratio for two unhunted herds in Denali and Gates of the Arctic National Parks typically averaged 60-67:100 (Nichols and Bunnell 1999). In more heavily hunted Alaskan herds, ram:ewe ratio ranged from 33:100 (heavily hunted) to 87:100 (lightly hunted). The ram:ewe ratios reported for the Mackenzie Mountains since 1995 (Appendix G) suggest that the harvest of rams in the Mackenzie Mountains is sustainable at current levels.

Table 8: Tags for big game species purchased by non-resident hunters with outfitters in the Mackenzie Mountains, 1995-2012.

Species	2012 396 hunters		2011 400 hunters		2010 384 hunters		2009 339 hunters		2008 391 hunters		2007 399 hunters		2006 407 hunters		2005 394 hunters		2004 337 hunters	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Dall's Sheep	270	68	251	63	253	66	215	63	261	67	266	67	276	68	246	62	229	68
Mountain Caribou	300	76	314	79	295	77	252	74	275	70	272	68	274	67	285	72	243	72
Moose	115	29	121	30	116	30	96	28	109	28	108	27	112	28	101	26	84	25
Mountain Goat	42	11	55	14	45	12	45	13	45	12	50	13	21	5	40	10	24	7
Wolf	292	74	285	71	294	77	252	74	228	58	227	57	201	49	214	51	166	49
Wolverine	153	39	163	41	171	45	133	39	111	28	150	38	108	27	154	39	89	26
Black Bear	16	4	32	8	28	7	22	6	2	1	7	2	3	1	40	10	8	2

Species	2003 347 hunters		2002 329 hunters		2001 339 hunters		2000 332 hunters		1999 321 hunters		1998 345 hunters		1997 352 hunters		1996 387 hunters		1995 343 hunters	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Dall's Sheep	257	74	218	66	220	65	231	70	227	71	246	71	252	72	252	65	218	64
Mountain Caribou	247	71	229	69	201	59	206	62	181	56	223	65	260	74	274	71	233	68
Moose	85	24	68	21	65	19	69	21	63	20	69	20	73	21	74	18	70	20
Mountain Goat	18	5	18	5	12	4	12	4	6	2	23	7	30	8	14	4	16	5
Wolf	207	60	159	48	137	40	155	47	89	28	165	48	209	59	193	50	72	21
Wolverine	141	40	97	29	83	25	85	26	65	20	99	29	135	38	114	30	35	10
Black Bear	9	3	3	1	0	0	6	2	2	<1	2	<1	8	2	0	0	0	0

Table 9: Observations of Dall's sheep reported by non-resident hunters in the Mackenzie Mountains, 2012.

	Number of Hunters Reporting	Number Observed	Mean Number Observed/hunter	% of Sheep Classified
Rams	165	2,528	15.0	36.3
Ewes[1]	151	2,881	19.0	41.4
Lambs	136	1,554	11.0	22.3

[1] includes females >1-yr-old, yearlings, and younger rams. Also called nursery sheep.

Fewer rams were classified by curl in 2012 than in most previous years (Table 10). This may have been a result of a low return in observation forms this year. Regardless, for the second consecutive year, hunters observed more legal (>¾ curl) rams (n=1,117) than rams with <¾ curl (n=987) in 2012. The mean number of legal rams observed per hunt was 8.0 (Table 10). This indicates an abundance of legal sized rams in the Mackenzie Mountains.

Table 10: Classification of Dall's sheep rams observed by non-resident hunters in the Mackenzie Mountains, 1995-2012.

Ram Class	2012		2011		2010		2009		2008		2007		2006		2005		2004	
	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl
Number of hunters reporting	140	124	149	133	158	142	139	132	184	174	150	168	180	171	186	182	188	183
Number of rams classified	1117	987	1234	1168	1314	1620	1040	1093	1520	1698	1902	2266	1769	2019	1787	1899	2185	2324
% of rams classified	53.0	47.0	51.4	48.6	44.8	55.2	48.8	51.2	47.2	52.8	45.6	54.4	46.7	53.3	48.5	51.5	48.5	51.5
Mean number of rams observed/hunt	8.0	8.0	8.0	9.0	8.3	11.4	7.5	8.3	8.3	9.8	11.0	13.5	9.9	12.0	9.6	10.4	11.6	12.7

Ram Class	2003		2002		2001		2000		1999		1998		1997		1996		1995	
	Horn > ¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl
Number of hunters reporting	127	121	148	133	186	174	151	147	144	138	177	177	205	205	172	174	181	180
Number of rams classified	1662	1654	1720	1720	1812	1765	1351	1717	1579	1756	1848	1924	1538	1586	1713	1699	2070	1645
% of rams classified	50.1	49.9	50.0	50.0	50.7	49.3	44.0	56.0	47.3	52.7	49.0	51.0	49.2	50.8	50.2	49.8	55.7	44.3
Mean number of rams observed/hunt	11.9	11.9	11.6	12.9	9.7	10.1	8.9	11.7	11.0	12.7	10.4	11.3	7.5	7.7	10.0	9.8	11.4	9.1

Northern Mountain Caribou (*Rangifer tarandus caribou*)

In their 2002 assessment, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the boreal population of woodland caribou as *Threatened* and the Northern Mountain population of woodland caribou as *Special Concern*. These two populations of woodland caribou were subsequently listed under the federal *Species at Risk Act* (SARA) in 2004 and 2007 respectively. Caribou of the Mackenzie Mountains are part of the Northern Mountain population of woodland caribou. In order to be more specific and to avoid confusion this report will use "northern mountain caribou" when referring to caribou from the Mackenzie Mountains.

Northern mountain caribou are another of the more desired species sought by non-resident hunters. Tags were purchased by 300 (76%) of non-resident hunters (Table 8), this is the second highest number of tags purchased since reporting started in 1991 (average 254, range 181-314). At least 56% of tag holders hunted caribou, harvesting 168 males, somewhat higher than the annual average harvest of 159 from 1991-2012 (Figure 5, Appendix F). The mean (±SD) length of a caribou hunt, determined from the 180 reports where hunters spent at least one day hunting, was 4.0±3.0 days (range 1-17 days), comparable to that of previous years (Table 11).

Since 2011 ENR began collecting, on a voluntary basis, front incisor teeth from caribou harvested by hunters in the southern portion of the Mackenzie Mountains. These teeth are forwarded to Matson's Laboratory for aging. Age is determined by counting the cementum annuli much like the growth rings of a tree. June 1 is used as the birth date for caribou (Matson 1981). We currently have ages from 30 harvested caribou; ages range from 2-11 years (mean 6.4 years, median 6.0 years; Figure 8).

We calculated ratios of 39.5 calves and 46.4 bulls (males) per 100 adult females (cows) based upon hunter classifications of northern mountain caribou observed during their hunts. Bulls comprised 25.0% of all caribou classified (Table 12). Both calf:cow ratios and bull:cow ratios are similar to the averages of 44:100 (range 36-59:100) and 38:100 (range 21-61:100), respectively, calculated since 1995 (Appendix G).

In 2012 we received antler lengths from 109 (65%) successful hunters; a higher percentage than in previous years. Antler measurement information sometimes goes unreported on outfitter forms. This year, as in other years, there was substantial variation in antler lengths, range 44.0-165.1 cm (17.3-65.0 in.). The maximum left and right antler lengths reported were 157.5 and 165.1 cm respectively (Table 13). The maximum antler length recorded by Boone and Crockett for northern mountain woodland caribou in North America is 158.5 cm (62.4 in) for a caribou taken from the Mackenzie Mountains in 1978 (Byers and Bettas 1999). Fourteen of the top 50 mountain woodland caribou recorded in the 12th edition of the Boone and Crockett Club record book are from the Mackenzie Mountains; the highest scoring antlers hold 7th place (Boone and Crockett Club, on-line trophy database accessed 2012).

Another measuring system for antlered animals is from Safari Club International (SCI), which has a unique all-inclusive record keeping system for measuring trophies, the most used system in the world. Unlike Boone and Crockett this system has no deductions or penalizing for asymmetry and provides points for all tines which is important for caribou (Jim Lancaster, personal communication). Eight of the top 20 mountain woodland caribou recorded in the Safari Club International record book are

from the Mackenzie Mountains, with a caribou harvested in 2006 holding second place in scoring (Safari Club International, on-line trophy database accessed 2012).

Since 1991 the percentage of bulls observed by clients in the Mackenzie Mountains has never been greater than 28%. This is a lower percentage than the cumulative 39% average adult bull component reported by Bergerud (1978) in his summary of eight North American caribou populations that were either non-hunted or hunted non-selectively (i.e. both males and females included in the harvest). Veitch et al. (2000c) classified 2,659 of an estimated 5,000 caribou in the central Mackenzie Mountains in August 1999 and reported only 25% of those animals were classified as males. Surveys done on the presumed rutting grounds of the South Nahanni caribou population in 1995, 1996, and 1997 reported 24, 28, and 20% of animals classified as males $\geq$1-year-old (Gullickson and Manseau 2000) and in 2001 reported 27% bulls (Gunn et al. 2002). A 2007 survey during the rut estimated 33.7 bulls:100 adult cows (R. Farnell and K. Egli, Yukon Territorial Government, unpublished data). A 2008 composition count during the rut in the same general area estimated a slightly higher ratio of 35.5 bulls:100 adult cows (Troy Hegel, personal communication).

Table 11: Mean length, SD, and range (in days) of northern mountain caribou hunts where at least one day was spent hunting from 2000-2012.

	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Number reports	180	187	175	155	190	172	171	191	120	172	181	178	141
Mean hunt length	4.0	3.0	4.0	4.0	3.0	4.0	4.3	3.7	4.9	3.8	3.6	4.3	4.0
SD	3.0	2.0	3.0	3.0	3.0	3.2	3.1	3.8	3.9	2.8	2.7	3.2	2.7
Range	1-17	1-16	1-14	1-14	1-15	1-16	1-14	1-32	1-34	1-14	1-12	1-15	1-12

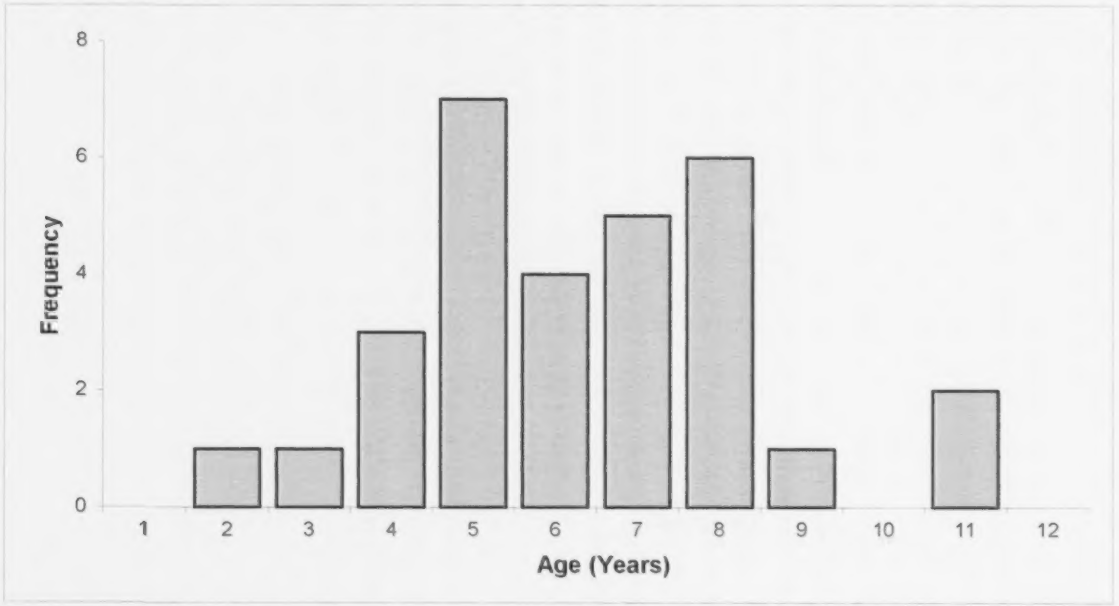

Figure 8: Ages of 30 caribou teeth voluntary provided by southern Mackenzie Mountain outfitters 2011-2012.

Table 12: Observations of northern mountain caribou reported by non-resident hunters in the Mackenzie Mountains, 2012.

Sex/Age Class	Number of Hunters Reporting	Number Observed	Mean Number Observed/hunter	% of Total Classified
Bulls	189	4,733	25.2	25.0
Cows	173	10,187	59.2	53.8
Calves	141	4,026	28.6	21.2

Table 13: Antler measurements of northern mountain caribou bulls harvested by non-resident hunters in the Mackenzie Mountains, 2012. All measurements are in cm (in).

	Contour Length	
	Left Antler	Right Antler
Number Measured	109	109
Mean (cm)	114.2 (45.0 in.)	114.0 (44.9 in.)
SD (cm)	56.1 (22.1in.)	56.1 (22.1 in.)
Maximum (cm)	157.5 (62.0 in.)	165.1 (65.0 in.)
Minimum (cm)	44.0 (17.3 in.)	45.5 (17.9 in.)

Nagy (2011), using movement data from satellite collared northern mountain caribou in the Sahtu (Olsen 2000, 2001) determined ten activity periods. The breeding period, or rut, was defined as 9-25 October. This period was also the activity period with the greatest daily movement rate (Nagy 2011). Hunter observation data are collected and the 1999 survey was carried out prior to the breeding period (Veitch et al. 2000c). Surveys conducted well before the rut or breeding period may underestimate the male component of the population. The surveys in 2007 and 2008 were conducted in late September and early October, just prior to the defined breeding period, and findings were more comparable to what Bergerud (1978) reported. Based upon hunter

observations there is some evidence that the proportion of males differs between populations and that this difference has been consistent over the past 20 years (Larter 2012a). Further investigation is required to explore demographic attributes of northern mountain caribou in the Mackenzie Mountains.

Northern mountain caribou in the Mackenzie Mountains are estimated to number between 15,000 and 20,000 from at least three separate populations shared between the YK and NWT: Bonnet Plume population (5,000 estimated), the greater Redstone population (a minimum of 10,000 observed; Richard Popko, personal communication), and the greater Nahanni population (2,700-3,000 estimated; Troy Hegel, personal communication). They are subjected to an annual bull-selective non-resident harvest averaging 159 males per year (1991-2012). The resident harvest of northern mountain caribou in the Mackenzie Mountains also tends to be bull-selective (but not restricted to bulls) and is generally light (*ca.* 30 animals/year); subsistence harvest includes both males and females, with the proportion of each dependent on the time of year that animals are harvested (J. Snortland unpublished data, ENR unpublished data). Subsistence harvesters in the Mackenzie Mountains include residents of both the NWT and YK Territory; harvest is not generally reported.

Studies on the Redstone herd of northern mountain caribou were initiated in March 2002, with ten female caribou being equipped with satellite radio collars as part of a study of caribou in the central and north-central Mackenzie Mountains initiated by the SRRB (Creighton 2006, Olsen 2000, 2001, Olsen et al. 2001). A recent analysis of these location data indicates that some of the collared animals in the range of the

Redstone herd are relatively sedentary year round, while others show the more typical seasonal migratory movements (John Nagy, personal communication).

Satellite radio collars were deployed on nine adult female caribou during March 2000 and October 2001 by the Yukon Department of the Environment (Jan Adamczewski, personal communication). These animals were believed to be part of the greater Nahanni herd. In October 2004, 18 female caribou were equipped with satellite collars along the YK-NWT border. These caribou were also believed to be from the greater Nahanni herd, but three animals were determined to be from the Finlayson herd. This was a co-operative study between YK Territorial Government, Parks Canada (NNPR) and the Wildlife Conservation Society (Weaver 2006). In October 2008, 30 female caribou were equipped with satellite collars along the YK-NWT border. Partners in this project include the YK Territorial Government, Parks Canada Agency, ENR, and the Canadian Parks and Wilderness Society, NWT Chapter (Troy Hegel, personal communication).

Moose (*Alces americanus*)

Tags to hunt moose were purchased by 29% (n=115) of non-resident hunters in 2012; the third highest reported (Table 8). At least 74% of tag holders hunted moose and harvested 85 bulls; the greatest number of moose harvested since reporting started in 1991 (range 32-85). Since 2005, the number of moose tags purchased has increased (Table 8, Appendix F). Success rates for moose hunts have remained relatively stable, but the increased number of tag sales in recent years has resulted in an increased overall harvest (Figure 9). The mean (±SD) length of a moose hunt, determined from

the 85 reports where hunters spent at least one day hunting, was 4.2±3.1 days (range 1-15 days), similar to what was reported for previous years (Table 14).

The increase in moose harvest starting in 2005 is likely in part related to the change in ownership of outfitting zone D/OT/01. This zone is one of the largest, with an abundance of good moose habitat. Prior to 2005, the annual harvest in this zone was low (<4 moose/year 1991-2004). The majority of clients wanted to hunt Dall's sheep; few were interested in hunting moose. The new owner has a client base which includes many European hunters who are specifically looking for trophy moose for European mounts. Additionally, moose were not hunted in the remote regions of the mountains because it simply wasn't viable for outfitters to hunt them. More recently what some people call the Alaska-Yukon moose has become a very popular hunt, with the Mackenzie Mountains emerging as one of the top destinations to have success in taking large moose (Jim Lancaster, personal communication).

Since the 2003 hunting season ENR has been collecting, on a voluntary basis, front incisor teeth from moose harvested by hunters in the southern portion of the Mackenzie Mountains. These teeth are forwarded to Matson's Laboratory for aging. Age is determined by counting the cementum annuli much like the growth rings of a tree. June 1 is used as the birth date for moose (Matson 1981). We currently have ages from 121 harvested moose; ages range from 3-15 years (mean 7.5 years, median 7.0 years; Figure 10).

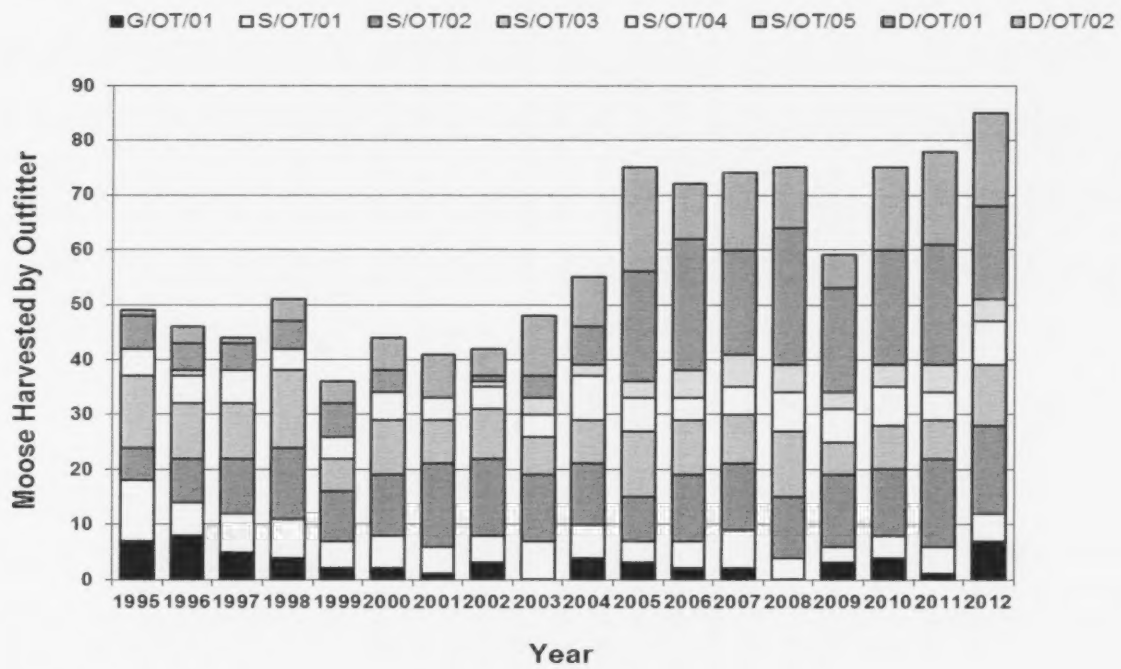

Figure 9: Moose harvested by individual Mackenzie Mountain outfitters from 1995-2012.

The mean (±SD) tip-to-tip spread of measured antlers (n=67) from bull moose harvested in 2012 was 142.9±59.6 cm (56.3±23.5 in.). This year we received the second highest number of antler measurements since records have been kept (Table 15). This year's maximum recorded antler spread was 161.0 cm (63.4 in.), less than the maximum recorded antler spread of 196.9 cm (77.5 in.) for a record moose taken in the NWT in 1982. Three moose taken from the Mackenzie Mountains are in the top 25 moose recorded in the record book of the Boone and Crockett Club and currently hold 16th, 22nd and 25th place respectively. A moose harvested in the NWT Mackenzie Mountains in 2008 was accepted in May 2009 and holds 25th place. A moose harvested

during the 2010 season ranks second as a Pope and Young World Record moose with a score of 241 5/8.

Table 14: Mean length, SD, and range (in days) of moose hunts where at least one day was spent hunting from 2000-2012.

	2012	**2011**	**2010**	**2009**	**2008**	**2007**
Number reports	85	86	86	68	82	80
Mean hunt length	4.2	4.1	4.5	4.2	3.6	4.0
SD	3.1	2.8	4.0	3.4	2.9	2.5
Range	1-15	1-14	1-18	1-14	1-16	1-9
	2005	**2004**	**2003**	**2002**	**2001**	**2000**
Number reports	85	49	60	46	42	48
Mean hunt length	4.4	4.8	3.9	3.6	3.7	4.4
SD	3.1	3.3	2.8	2.6	2.9	2.7
Range	1-14	1-12	1-14	1-12	1-12	1-12

We calculated ratios of 32.7 calves:100 adult females (cows) and 87.5 bulls:100 cows based upon hunter observations of moose during hunts (Table 16, Appendix G). The calves:100 adult females in 2012 is higher than the average 30:100 calf:cow ratio recorded since 1995. Since 2004 the ratio has been $\geq$30:100. This is still lower than the 40-60:100 that is generally documented during early to mid-winter aerial surveys for moose along the Mackenzie River in the vicinity of the communities of Fort Good Hope (MacLean 1994a), Norman Wells (Veitch et al. 1996) and Tulita (MacLean 1994b) (Appendix G). However, these surveys were conducted after the major fall subsistence harvest and variable female harvest can certainly impact the interpretation of calf:cow

ratios. As no research has been done on moose in the Mackenzie Mountains, we have no explanation for the apparent discrepancy in calf production, survival, or both between the mountains and the river valley. A survey of moose in the Norman Wells study area in January 2001 estimated a calf:cow ratio of 18:100 (ENR Norman Wells unpublished data), and an aerial survey of the Mackenzie River Valley and vicinity in the Dehcho region south from the Blackwater River to Jean Marie River conducted in November 2003 estimated 32:100 (Larter 2009). These studies indicate that low calf:cow ratios may not be restricted to the Mackenzie Mountains and that further studies are required to determine the cause(s). A program was established to document calf:cow ratios annually in November in the Mackenzie and Liard River Valleys of the Dehcho (Larter 2009). An aerial survey conducted in November 2011 of the Mackenzie River Valley and vicinity south from the Blackwater River to Jean Marie River estimated a calf:cow ratio of 54:100 (N. Larter and D. Allaire unpublished data).

The bull:cow ratio of 87.5:100 reported for 2012 is lower than the 104:100 average from 1995-2012, but is within the reported range of 76-137:100 (Appendix G). Bull:cow ratios from the Mackenzie Mountains continue to be generally higher than the range of 27-105:100 reported in the Yukon (R. Ward cited *in* Schwartz 1997) and 16:100 from heavily harvested populations in Alaska (Schwartz et al. 1992), and average of 46:100 from Norway, range (25-69:100) (Solberg et al. 2002). There has been concern that low bull:cow ratios could influence conception dates, pregnancy rates and newborn sex ratios (Bishop and Rausch 1974, Crête et al. 1981, Solberg et al. 2002) and that management strategies should maintain a high bull:cow ratio (Bubenik 1972).

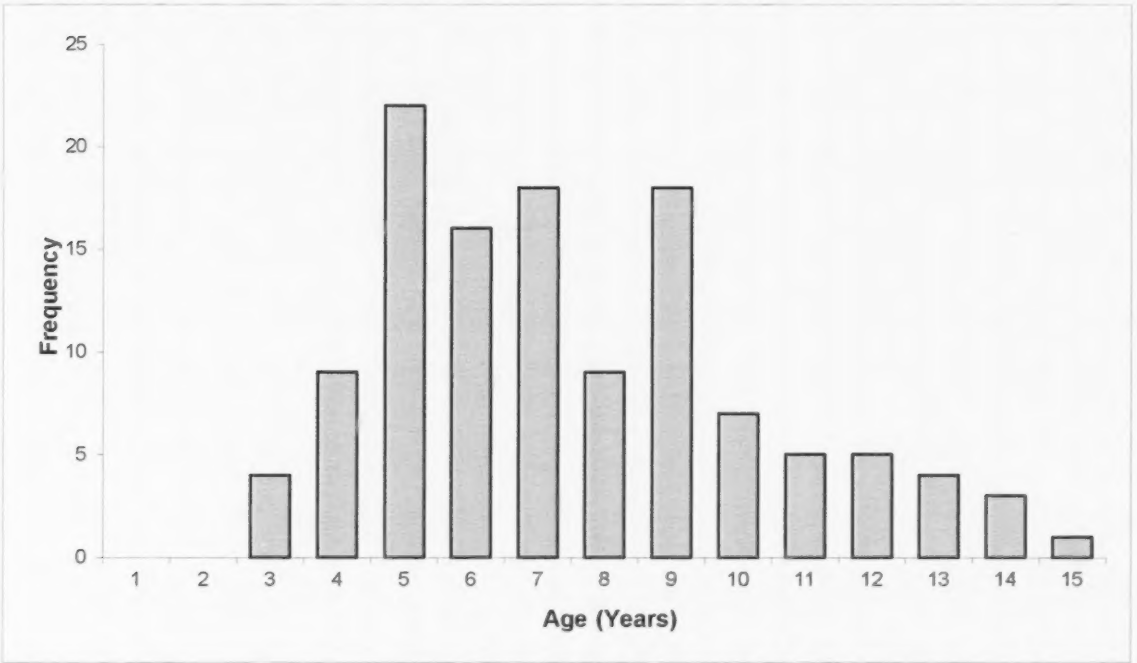

Figure 10: Ages of 121 moose teeth voluntary provided by southern Mackenzie Mountain outfitters 2003-2012.

Studies on tundra moose in Alaska have not found evidence that moose populations with low bull:cow ratios have reduced reproductive rates (Schwartz et al. 1992); populations with a more skewed sex ratio had a relative rate of population increase greater than populations without a skewed sex ratio (Van Ballenberghe 1983). However, a recent study of eight heavily harvested moose populations in Norway indicated a relationship between declining recruitment rate and skewed adult sex ratio (Solberg et al. 2002). Based upon hunter observations since 1995, there is no indication of any decreasing trend in the bull:cow ratio of moose in the Mackenzie Mountains, hence the adult sex ratios are an unlikely factor in the low calf:cow ratios reported. The reported sex ratios may have an inherent bias towards a greater number of bulls if harvesters consistently spend more time searching for moose in areas frequented more by large males than females.

Table 15: The yearly mean and range of measured bull moose tip-to-tip antler spread in cm (in).

	2012	2011	2010	2009	2008	2007	2006
Measured (n)	67	69	65	53	63	62	56
Mean spread	142.9 (56.3)	144.0 (56.7)	143.5 (56.5)	143.5 (56.5)	145.5 (57.3)	141.1 (55.6)	141.3 (55.6)
Range	98-161 (38.6-63.4)	113-168 (44.5-66.1)	106-174 (41.7-68.5)	92-175 (36.2-68.9)	101-174 (39.8-68.5)	102-179 (40.2-70.5)	107-170 (42.1-66.9)

	2005	2004	2003	2002	2001	2000	1999
Measured (n)	53	38	34	32	32	34	26
Mean spread	144.9 (57.0)	150.3 (59.2)	150.0 (59.1)	149.3 (58.8)	144.3 (56.8)	147.0 (57.9)	144.2 (56.8)
Range	122-165 (48.0-65.0)	127-174 (50.0-68.5)	107-165 (42.1-65.0)	103-178 (40.6-65.0)	113-165 (44.5-65.0)	127-179 (50.0-70.5)	109-166 (42.9-65.4)

Table 16: Observations of moose reported by non-resident hunters in the Mackenzie Mountains, 2012.

Age/Sex class	Number of Hunters Reporting	Number Observed	Mean Number Observed/Hunter	% of Total Classified
Bulls	110	463	4.2	39.8
Cows	107	529	4.9	45.4
Calves	75	173	2.3	14.8

Mountain Goat (*Oreamnos americanus*)

Sales of mountain goat tags show more annual fluctuation than any other ungulate species harvested by non-resident hunters in the Mackenzie Mountains, range 6-55 during 1995-2012 (Table 8) with a mean annual harvest of nine goats (range 1-21) over the same time (Appendix F). In 2012, mountain goat tags were purchased by 42 (11%) of non-resident hunters. Twelve goats were harvested in 2012, all males. This year's harvest level was similar to 2006 and 2010 (Appendix F). The mean (±SD) length

of a goat hunt, determined from the 17 reports where hunters spent at least one day hunting, was 2.8±1.7 days (range 1-7 days), within the range of what was reported in previous years (Table 17).

Mountain goats are known to inhabit five of the eight outfitting zones in the Mackenzie Mountains, occurring almost exclusively below 63°00'N (Veitch et al. 2002). They are most numerous in high relief terrain along the YK-NWT border between 61°00' and 62°00'N. However, since 1995 we have received hunter observations or harvest reports of goats from only four of those outfitter zones - D/OT/01, D/OT/02, S/OT/03, and S/OT/04 (Figure 1). In 2012, observations and harvest of mountain goats by hunters came from just two zones, D/OT/01 (n=66), and D/OT/02 (n=191). We estimated 51.8 goat kids and 71.9 billies per 100 nannies based upon hunter observations. The goat kid:nannie ratio was lower than the average 62.3:100 from 2002-2012, while the billie:nannie ratio was higher than the average 65.1:100 from 2002-2012 (Appendix H).

Table 17: Mean length, SD, and range (in days) of goat hunts where at least one day was spent hunting from 2000-2012.

	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Number reports	17	20	13	22	21	27	12	18	8	6	4	2	1
Mean hunt length	2.8	2.3	3.2	2.5	3.0	2.7	2.8	3.8	3.9	3.0	2.8	1.5	3.0
SD	1.7	1.2	1.9	2.0	1.8	1.7	1.5	2.8	1.6	2.6	1.9	0.7	n/a
Range	1-7	1-5	1-7	1-8	1-8	1-6	2-6	1-14	2-6	1-8	1-5	1-2	3

In 2005, we began estimating the age of harvested goats based upon counting horn annuli, and have tried to age as many harvested goats as possible since then. Of the 116 goat (104 billies and twelve nannies) ages we have to date the age range is 2.5-15.5 years with 68 aged <8 years, 48 aged >8 years, and 30 animals >10 years (Figure 11). Of the 12 male goats aged in 2012, three were aged >10 years. The longest horns from a mountain goat taken in 2012 were 24.5 cm (left) and 23.5 cm (right). No mountain goats from the NWT are listed in the 11th edition of the Boone and Crockett Club record book (Byers and Bettas 1999). Based upon the horn age and length data over the past seven years there may be a somewhat linear relationship between age and horn length from 5.5-11.5 years, but at ages before or after that there is almost no relationship, implying that large horned animals are found over a wide range in animal ages (Figure 12).

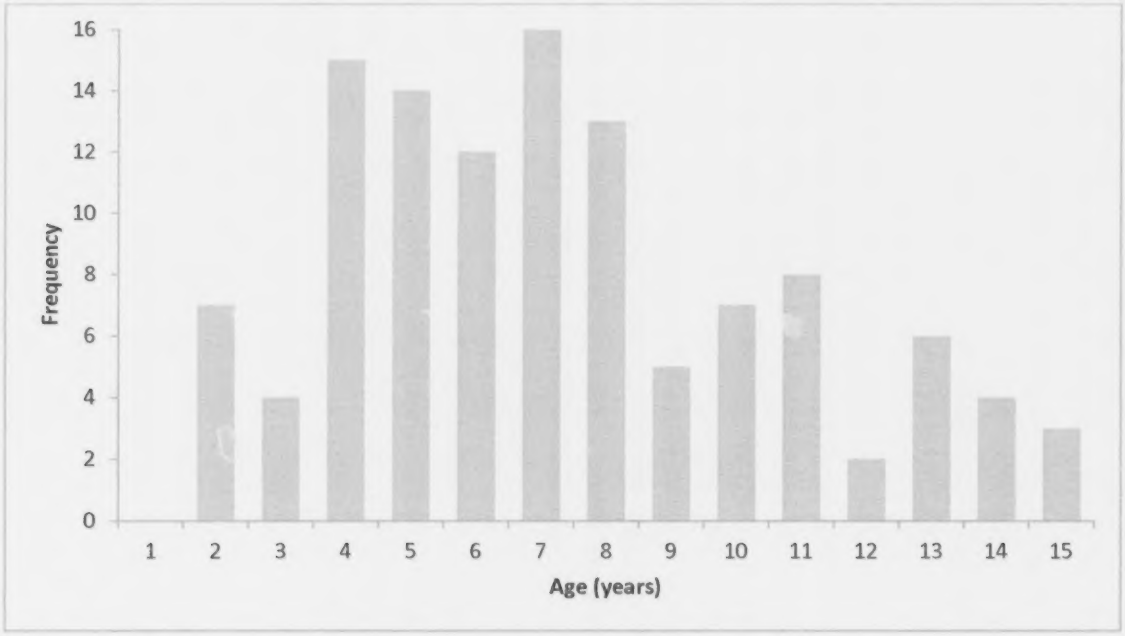

Figure 11: Ages of 116 mountain goats harvested in the southern Mackenzie Mountain based upon counting horn annuli 2005-2012.

There is some evidence that goat numbers and distribution have been increasing in zone D/OT/02 in the southern Mackenzie Mountains (Larter 2004, Jim and Clay Lancaster, and Werner Aschbacher, personal communication). The total number of goats observed has been increasing in recent years and billies have been observed in places they had not been seen previously in zone D/OT/02 (Clay Lancaster, personal communication; Appendix H).

In a 2.5 hr rotary-winged survey of zone D/OT/02 on 11 September 2006, 88 goats were observed (38 billies, 27 nannies, 19 goat kids, and 4 yearlings), producing estimates of 140.8 billies and 70.4 goat kids per 100 nannies (N. Larter unpublished data). This survey was conducted in an area that could not be surveyed during a 2004 aerial survey and provided similar numbers of goats and ratio estimates as the 110.7 billies and 71.4 kids per 100 nannies from that 2004 survey (Larter 2004). A rotary-

wing survey was conducted 22-24 August 2011 in the Ragged Range area of zone D/OT/01. 278 goats were observed (124 billies, 80 nannies, 50 goat kids, 6 yearlings; 18 goats were unclassified), producing estimates of 155.0 billies and 62.5 goat kids per 100 nannies (Larter 2012b). These survey results generally support the contention of increasing goat numbers and distribution but we acknowledge there was seven years between surveys. ENR will continue to work with outfitters in zones D/OT/01 and D/OT/02 to better assess the current status of mountain goats in the Mackenzie Mountains.

The increased harvest of mountain goats since 2004 (Appendix F) may be related to changes in accessibility to the more remote and rugged parts of the various outfitter ranges where goats are resident. The use of rotary aircraft in recent years has permitted outfitters to get into some areas of their zones where they have never been before, areas where goats have been found. This increased accessibility to areas of untouched goat range has likely had some effect on the increased success in goat harvest.

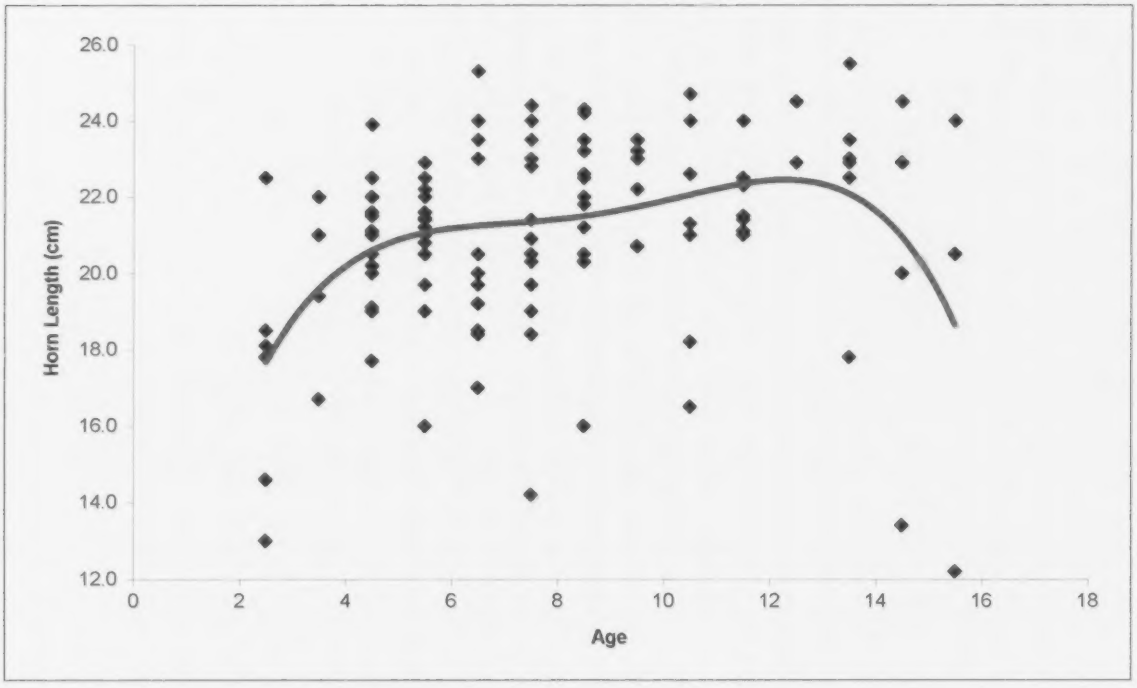

Figure 12: The relationship between the horn length (cm) and age (based upon horn annuli) of 116 mountain goats harvested in the Mackenzie Mountains 2005-2012. Line of best fit is a 4th order polynomial.

Wolf (*Canis lupus*)

Wolf tags were purchased by 74% (n=292) of non-resident hunters in 2012 (Table 8). This is the second highest number of tags and the second highest proportion of hunters purchasing tags in any year since the 1995 reporting of observations began (Table 18). At least 26% (n=77) of tag holders actively hunted wolves, with 24 wolves being harvested (three males, five females and 16 of unreported sex) (Appendix F). This is the greatest number of wolves harvested since reporting started in 1991, and higher than the yearly average of 15 from 1991-2011. Hunters reported spending 1-10 days actively hunting wolves (mean ±SD of 4.8±2.8 days). This is the fourth year that wolves were hunted during the winter; five wolves (two males and three females) were harvested in March and April 2013 in zone S/OT/01.

The number of wolves observed in 2012 (n=253) falls within the range of observations from previous years (range 142-317). There is no relationship between the number of wolves observed/year and annual harvest nor does the number of tags purchased/year explain annual differences in wolf observations (Table 18). Only 1.5% of responding hunters indicated that they believed wolf numbers were high, generally less than in previous years, and all those comments came from zones G/OT/01 and S/OT/05. The year 2000 was the first year that hunters commented on wolf numbers on the wildlife observation forms. The number of hunters reporting since 2001 has been consistently higher than in previous years, which is attributed to a change in how we defined hunter reporting. For data collected after 2001, we assumed that all returned observation forms where there was a blank, a zero, or a dash in the box indicating the number of wolves observed was a report of no wolves being observed. When looking at the forms this seemed like a reasonable assumption. This assumption may well be invalid for previous years' data and would bias the post 2001 values to be higher than the previous years.

Table 18: Observations of wolves reported by non-resident hunters in the Mackenzie Mountains, the number of wolves harvested and the number of wolf tags purchased, 1995-2012.

	2012[1]	**2011[1]**	**2010[1]**	**2009[1]**	**2008[1]**	**2007[1]**	**2006[1]**	**2005[1]**	**2004[1]**
# hunters reporting	215	218	203	194	244	244	239	254	244
# wolves observed	253	184	203	167	260	262	202	245	317
# hunters seeing ≥1	45	74	61	65	76	88	84	76	81
Number harvested	24	21	19	20	17	12	23	19	18
Number wolf tags	292	285	294	252	228	227	201	204	166
	2003[1]	**2002[1]**	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**	**1995**
# hunters reporting	203	197	142	116	103	148	141	76	119
# wolves observed	200	249	215	228	142	148	200	186	269
# hunters seeing ≥1	74	69	65	61	40	57	76	26	26
Number harvested	12	11	15	14	11	9	17	11	14
Number wolf tags	207	159	137	145	89	165	209	194	72

[1]Change in reporting since 2002 may have resulted in the number of hunters reporting for 1995-2001 being artificially low, see text.

Wolverine (*Gulo gulo*)

Wolverine tags were purchased by 39% (n=153) of non-resident hunters in 2012 (Table 8). This is the fourth highest number of tags and proportion of hunters purchasing tags in any year since the 1995 reporting of observations began (Table 19). At least 22% (n=34) of tag holders actively hunted wolverine, no wolverines were harvested in 2012. Hunters reported spending from 1-10 days actively hunting wolverine (mean ±SD of 5.1±2.6 days). Hunters reported seeing three groups of two, and 23 observations of solitary wolverines. Observations were reported from seven of the eight outfitter zones this year; most observations came from D/OT/02 and G/OT/01 (Figure

8). Historically, wolverine observations have been mostly of solitary animals with few family groups being observed. The number of animals observed this year continues an increasing trend from 2007, and is similar to the numbers observed during 1995-1999 and 2004-2006 (Table 19, Figure 13). Wolverine numbers are believed to be declining in other parts of their range in the NWT (Suzanne Carrière, personal communication); our observations since 1995 in the Mackenzie Mountains are equivocal.

There is no relationship between the number of wolverine observed/year and annual harvest nor does the number of tags purchased/year explain annual differences in wolverine observations (Table 19). Wolverines occur throughout the Mackenzie Mountains, but sightings are considered rare. Most wolverine observations are made in hunting zones G/OT/01, S/OT/01, S/OT/05 and D/OT/02.

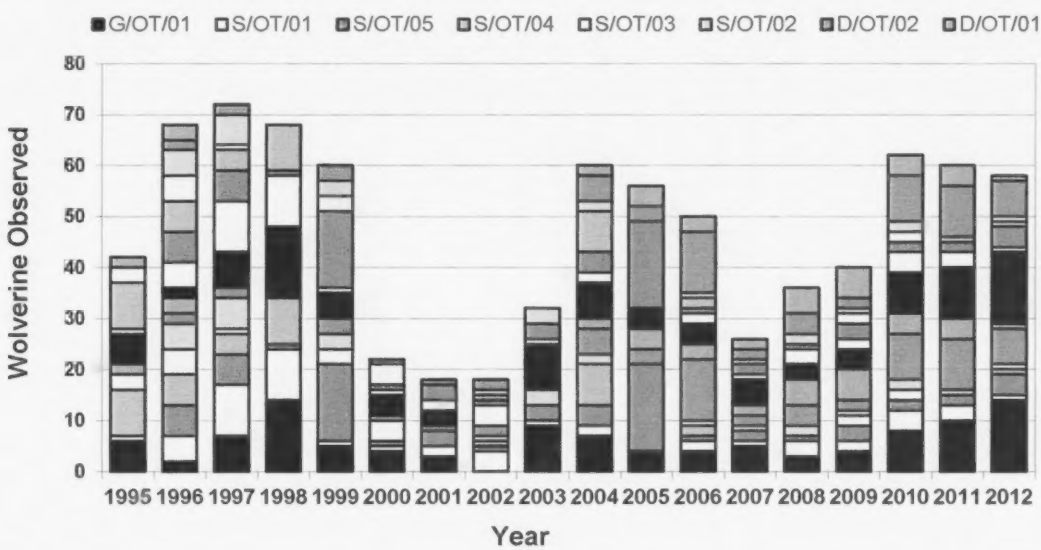

Figure 13: The number of wolverine observed by hunters from 1995-2012 and the outfitter zones where the observations occurred. Data are based upon voluntary hunter observation forms.

Table 19: The number of reported observations of wolverine, the number of wolverine harvested, the number of hunters with wolverine tags, the percentage of total hunters with wolverine tags, and the total number of hunting licences purchased for 1995-2012.

Year	2012	2011	2010	2009	2008	2007	2006	2005	2004
Reported Observed	29	30	31	20	18	13	25	28	30
Number Harvested	0	2	3	3	1	0	1	1	0
No. Wolverine Tags	153	163	171	133	111	150	108	154	89
% Wolverine Tags	39	41	45	39	28	37	27	39	26
Total Hunting Licences	396	400	384	339	399	405	407	394	337
Year	**2003**	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**	**1995**
Reported Observations	12	9	9	11	30	34	36	34	21
Number Harvested	0	1	2	0	3	0	1	4	1
No. Wolverine Tags	141	97	83	78	65	99	135	114	35
% Wolverine Tags	40	29	26	23	20	29	38	29	11
Total Hunting Licences	347	338	332	332	321	345	352	387	344

Black Bear (*Ursus americanus*)

This year 16 tags were purchased by non-resident hunters for black bears (Table 8), but no bears were harvested. Black bears are relatively rarely seen in the Mackenzie Mountains and in most years are reported only from south of 63°00'N. Only five black bears have been harvested in the past 22 years. In 2012, 37 black bears (34 adults and three cubs) were reported on returned hunter observation forms (Table 20). The number of black bears observed in 2012 falls within the range of 17-56 observed during 2003-2011 (Table 20). This year bears were observed in five outfitter zones D/OT/01, D/OT/02, S/OT/01, S/OT/02, and S/OT/05, with some being seen north of 64°00'N. As with the other post 2001 carnivore data, we assumed that all returned observation forms where blanks, zeroes, or dashes occurred in the boxes indicating the number of

carnivores observed was a report of no carnivores being observed. This assumption is likely invalid for previous years' data and likely somewhat inflates the post-2001 values relative to 1996-2001 values.

Table 20: Observations of black bears reported by non-resident hunters (including non-hunting guides) in the Mackenzie Mountains, 1995-2012.

	2012[1]		2011[1]		2010[1]		2009[1]		2008[1]		2007[1]		2006[1]		2005[1]		2004[1]	
	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad
Total # Observed	3	34	2	27	0	29	3	14	8	48	4	34	2	27	4	21	1	23
% of Total Observed	8	92	7	93	0	100	18	82	14	86	11	89	7	93	16	84	4	96
No. Hunters Reporting	216	216	218	218	203	203	194	194	244	244	244	244	239	239	256	256	229	229
No. Hunters Saw at Least 1	1	7	2	19	0	8	3	10	3	10	2	17	1	14	3	18	1	19
Maximum # Observed	2	3	1	8	0	2	1	3	3	4	2	8	2	11	2	2	1	3

	2003[1]		2002[1]		2001		2000		1999		1998		1997		1996		1995[2]
	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	All Bears
Total # Observed	3	34	3	17	0	7	2	15	4	7	0	15	2	3	1	10	11
% of Total Observed	8	92	15	85	0	100	12	88	36	64	0	100	40	60	9	99	nil
No. Hunters Reporting	191	191	199	199	127	130	88	93	87	89	121	124	96	96	6	14	44
No. Hunters Saw at Least 1	2	21	2	14	1	7	1	10	2	6	0	8	2	3	1	9	9
Maximum # Observed	2	7	2	3	0	1	2	3	2	2	0	3	1	1	1	2	2

[1] Change in reporting for 2002 may have resulted in artificially lower numbers of hunters reporting for 1995-2001, see text.
[2] All bears not separated out by cubs and adults.

Grizzly Bear (*Ursus arctos*)

The Mackenzie Mountains have been closed to non-residents for hunting grizzly bears since 1982 and resident hunters have been restricted to one bear per lifetime since the same year (Veitch 1999). It is clear from hunter comments on voluntary observation forms that, despite the lack of hunting opportunities, grizzly bears in the Mackenzie Mountains remain a subject of considerable interest for non-resident hunters and their guides (Appendices C, D). As over the past 14 years, hunters in 2012 reported the loss of meat, capes and food to grizzly bears, and commented that there were too many grizzly bears and a hunt should be considered. Outfitters also continue to mention camp and equipment damage by grizzly bears both during and after the season. Even though moose calf numbers, based upon hunter observations, are generally lower in the Mackenzie Mountains than those reported in the Mackenzie Valley, and predation by grizzly bears could be a potential cause (Ballard 1992), there were few hunter comments indicating low moose or caribou calf numbers. A frequent comment of guided hunters is that bears have lost their fear of humans because of a lack of hunting and they were concerned that this was a human safety issue. Although there have been no documented injuries from grizzly bear attacks in the Mackenzie Mountains since the closure of the non-resident grizzly bear hunting season (Veitch 1999), there were three incidents in 2012 in the southern Mackenzie Mountains where grizzlies claimed either meat or hides from kills while guides were in the vicinity or while they were at camp. In most instances the grizzlies came at night, took the meat, and left without incident (Carl Lafferty, personal communication). Since 1993 there have been 61 nuisance grizzly bears killed, the majority in the Sahtu (n=37) and Gwich'in (n=14) regions with ten in the Dehcho Region (ENR Norman Wells and Fort Simpson unpublished data). One

nuisance grizzly bear was killed this year in the Dehcho region of the Mackenzie Mountains. To minimize human-grizzly bear interactions electric fences have been used at main camps, temporary camp use has been reduced, clean camp policy has become standard, and some known high-use grizzly bear areas have been avoided.

While the mean number of adult grizzly bears observed by hunters has fluctuated around a mean of 300 from 1996-2012, the cub to adult ratio calculated from the hunter observations has shown marked fluctuations (Figure 14, Table 21). There was a peak in 2000, with 40 cubs/100 adult bears observed, followed by a decline to a low of 14 cubs/100 adult bears in 2003. Subsequently there was an increase to 33-35 cubs/100 adult bears for three of the next four years, followed by declining cubs/100 adult bears for 2010-2012 to 23 cubs/100 adult bears (Figure 14, Table 21). Because cub grizzlies in the Mackenzie Mountains tend to stay with their mothers for three years (Miller et al. 1982), reported observations of 'cubs' likely refers to cubs-of-the-year, yearlings, and two-year-old bears. Miller et al. (1982) documented a low reproductive rate for female grizzly bears in the Mackenzie Mountains, with no sows less than eight-years-old producing cubs, an average inter-litter interval of 3.8 years, and a mean litter size of 1.8. The cubs/100 adult bears determined from reported hunter observations during 1996-2012 show some periodicity, but whether it matches an underlying four year interval is debatable (Figure 14). What is currently happening may or may not be similar to what was reported by Miller et al. (1982) during 1973-1977 when there was non-resident hunting of grizzly bears.

We estimated the mean litter size from hunter observation reports by analyzing just those observations of groups of grizzly bears where cubs were present with only

one adult. The estimated mean litter size in 2012 was 1.6, which falls within the range of 1.4-2.0 reported from 1996-2012 for the Mackenzie Mountains and falls between the mean found by Miller et al. (1982) and the 2.2 reported for grizzly bears of Kodiak Island, Alaska (Troyer and Hensel 1964). The demographic parameters of Mackenzie Mountain grizzly bears estimated during 1996-2012 remain generally comparable to those reported during 1973-1977 by Miller et al. (1982).

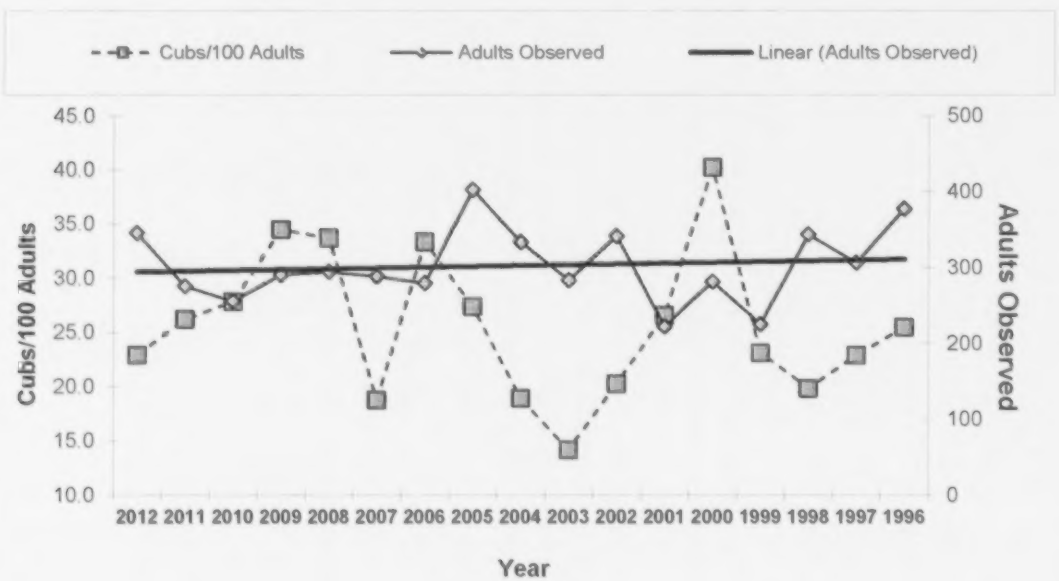

Figure 14: The number of 'cubs'/100 adults and the total number of adult grizzly bears observed by hunters from 1996-2012. Data are based upon voluntary hunter observation forms. The linear trend of total adult bears observed during the same time period is indicated.

Table 21: Observations of grizzly bear reported by non-resident hunters in the Mackenzie Mountains, 1995-2012; total number of bears observed, % of cubs/adults, number of hunters reporting grizzly observations, number of hunters seeing at least one cub/adult, the mean and maximum number of cub/adults observed.

	2012		2011		2010		2009		2008		2007		2006		2005		2004	
	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult
Total # Observed	79	345	72	275	71	255	100	290	99	294	54	288	93	279	110	402	63	333
% of Total #	19	81	21	79	22	78	26	74	25	75	16	84	25	75	21	79	16	84
# Hunters reporting	46	138	38	123	33	104	47	109	48	139	28	127	50	122	49	150	34	131
# Hunters saw ≥1	24	71	28	65	25	53	36	64	31	64	17	56	32	70	10	65	15	57
Mean # Observed	1.7	2.5	1.9	2.2	2.2	2.5	2.1	2.7	2.1	2.1	1.9	2.3	1.9	2.3	2.0	2.3	1.9	2.5
Max. # Observed	5	14	4	10	5	11	6	20	6	12	5	15	5	12	10	16	4	15

	2003		2002		2001		2000		1999		1998		1997		1996		1995
	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	All Bears[1]
Total # Observed	40	283	69	341	59	222	113	281	52	225	68	343	70	306	96	377	389
% of Total #	12	88	17	83	21	79	29	71	19	81	17	83	19	81	20	80	nil
# Hunters reporting	19	120	34	128	136	171	108	131	98	117	139	177	110	170	49	132	138
# Hunters saw ≥1	9	53	11	48	28	104	51	97	28	81	31	105	32	129	46	129	123
Mean # Observed	2.1	2.4	2	2.7	0.4	1.3	1.1	2.1	0.5	1.9	0.5	1.9	0.6	1.8	2.0	2.9	2.8
Max. # Observed	12	7	8	20	5	10	8	12	4	12	6	16	12	17	5	15	16

[1] All bears were not separated out by cubs and adults.

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We appreciate the continued co-operation from the Association of Mackenzie Mountain Outfitters and each individual outfitter operation in the Mackenzie Mountains. We thank them for the extra efforts they make in completing, signing, and sending us their harvest reports and meat distribution forms. We especially want to thank those outfitters who spent additional time compiling and sending additional information so that this report could be completed in a timely fashion.

We thank Renewable Resources Officers and clerks with ENR in Norman Wells, Fort Simpson, and Fort Liard for collecting and organizing data from non-resident hunters in their respective offices. We also greatly appreciate the efforts, interest, and co-operation shown by our visiting hunters and the more than 80 guides that completed the forms, reported observations of animals seen, did the various antler and horn measurements, and in some cases provided biological samples. We would particularly like to thank those hunters that took the time to write comments about their hunting experience.

John Nagy provided unpublished data from Richardson Mountain Dall's sheep work and a reanalysis of satellite collared mountain caribou data. We gratefully acknowledge the Boone and Crocket Club for providing us with access to their on-line trophy database and Safari Club International for providing us with caribou data from their on-line trophy database. Matson's Laboratory aged all of the moose and mountain caribou teeth.

PERSONAL COMMUNICATIONS

Jan Adamczewski, Ph.D., Wildlife Biologist, Ungulates. Environment and Natural Resources. Yellowknife, NWT

Werner Aschbacher. South Nahanni Outfitting. Whitehorse, YT

Suzanne Carrière, Ph. D., Wildlife Biologist (Biodiversity). Environment and Natural Resources. Yellowknife, NWT

Harold Grinde, President. Association of Mackenzie Mountain Outfitters. Rimbey, AB

Troy Hegel, Ungulate Biologist (Caribou/Sheep/Goat). Fish and Wildlife Branch Yukon Environment. Whitehorse, YT

Kelly Hougen, Past-President. Association of Mackenzie Mountain Outfitters. Whitehorse, YT

Jayne Konisenta, Acting Chief, Nahanni Butte Dene Band, Nahanni Butte, NWT

Carl Lafferty, Regional Superintendent. Environment and Natural Resources. Fort Simpson, NWT

Richard Popko, Manager Wildlife Research and Monitoring. Environment and Natural Resources. Norman Wells, NWT

Clay Lancaster, Nahanni Butte Outfitters. Charlie Lake, BC

Jim Lancaster, Nahanni Butte Outfitters. Smithers, BC

John Nagy, Ph. D., University of Alberta. Edmonton, AB

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APPENDIX A

Outfitters licenced to provide services to non-resident hunters in the Mackenzie Mountains, NWT – 2012.

D/0T/01 – SOUTH NAHANNI OUTFITTERS LTD.
Werner and Sunny Aschbacher
PO Box 31119
Whitehorse, YT Y1A 5P7
Ph: (867)-399-3194
Fx: (780)-665-7076
e-mail: huntnahanni@gmail.com
website : www.huntnahanni.com

D/0T/02 – NAHANNI BUTTE OUTFITTERS
Clay and Jim Lancaster
PO Box 3854
Smithers, BC VOJ 2N0
Ph: (250)-846-5309
2nd Ph: (250)-263-9197
e-mail: jladventures@xplornet.com
website: www.lancasterfamilyhunting.com

G/0T/01 – ARCTIC RED RIVER OUTFITTERS
Tavis Molnar
PO Box 1
Whitehorse, YT Y1A 5X9
Ph: (867)-633-4934
Fx: (867)-633-4934
e-mail: info@arcticred-nwt.com
website: www.arcticred-nwt.com

S/0T/01 – GANA RIVER OUTFITTERS
Harold Grinde
P.O. Box 528
Rimbey, AB T0C 2J0
Ph: (403)-357-8414
e-mail: ganariver@pentnet.net
website: www.ganariver.com

S/0T/02-MACKENZIE MOUNTAIN OUTFITTERS
Stan and Helen Stevens
P.O. Box 175
Dawson Creek, BC V1G 4G3
Ph: (250)-786-5118
Fx: (250)-786-5404
e-mail: mmostanstevens@gmail.com
website: www.mmo-stanstevens.com

S/0T/03 – RAM HEAD OUTFITTERS
Stan and Debra Simpson
P.O. Box 89
Warburg, AB T0C 2T0
Ph: (780)-848-7578
Fx: (780)-848-7550
e-mail: ramheadoutfitters@hotmail.com
website: www.ramheadoutfitters.com

S/0T/04 - NWT OUTFITTERS
Eric and Lorna Mikkelson
PO Box 106
Lazo, BC V9N 8Z8
Ph: (888)-293-2299
Fx: (250)-897-0054
e-mail: nwtoutfitters@shaw.ca
website: www.nwtoutfitters.com

S/0T/05 - REDSTONE TROPHY HUNTS
Dave Dutchik
P.O. Box 1172
Cochrane, AB T4C1B2
Cell: (250)-261-9962
Ph/Fx: (403)-975-8862
e-mail: redstonehunts@yahoo.ca
website: www.redstonehunts.com

APPENDIX B

Summary of fees, bag limits, and seasons for big game species available to non-resident hunters in the Mackenzie Mountains, NWT - 2012. [Note: all prices are in Canadian funds.]

Species	Status	Tag Fee	Trophy Fee	Bag Limit	Season
Black Bear	Non-resident	$40.00	$200.00	1 adult bear not accompanied by a cub	15 Aug - 31 Oct
	Non-resident alien	$100.00	$200.00		15 Aug – 30 June
Woodland Caribou	Non-resident	$40.00	$400.00	1	25 Jul - 31 Oct
	Non-resident alien	$100.00	$400.00		
Mountain Goat	Non-resident	$40.00	$400.00	1	15 Jul - 31 Oct
	Non-resident alien	$100.00	$400.00		
Moose	Non-resident	$40.00	$400.00	1	1 Sep - 31 Oct
	Non-resident alien	$100.00	$400.00		
Dall's Sheep	Non-resident	$40.00	$400.00	1 adult male with min. ¾ curl	15 Jul - 31 Oct
	Non-resident alien	$100.00	$400.00		
Wolf	Non-resident	$40.00	$200.00	1 or 2[2]	25 Jul - 31 Oct
	Non-resident alien	$100.00	$200.00	2	1 Aug - 15 Apr
Wolverine	Non-resident	$40.00	$200.00	1	25 July - 31 Oct
	Non-resident alien	$100.00	$200.00		25 July - 31 Oct

Source: Department of Environment and Natural Resources. 2012. Northwest Territories Summary of Hunting Regulations. Department of Environment and Natural Resources, Yellowknife, NWT. 34 pp.

[2] One wolf limit from D/OT/01-02 and G/OT/01, and 2 wolf limit from S/OT/01-05.

APPENDIX C

Comments provided from non-resident hunters in the Mackenzie Mountains, NWT on voluntary Hunter Wildlife Observation Report forms, 2012. We have not printed actual names of outfitters or their guides (XXX).

Perfect!

Very reliable. Safe & professional. The whole operation works very good & provides a great hunting experience. The guide made the hunting trip a fantastic one.

Have hunted many places in the world, and since I was 12 years old. XXX represent to us the best place we been. Everything is well organized from the first e-mail to, logistics, guide, food, everything. Awesome nature, good to see a lot of healthy animals.

XXX was an excellent outfitter. Great people and very well run operation. We saw a lot of game.

Have hunted many places in the world, and since I was 12 years old. XXX represent to us the best place we been. Everything is well organized from the first e-mail to, logistics, guide, food, everything. Awesome nature, good to see a lot of healthy animals.

Amazing hunt, excellent service and excellent hospitality.

Amazing hunt, plan to be a member of the frequent flier program. Not to be missed.

The place and the outfitter are excellent and any hunter have what he came looking for

Bloody awesome outfitter mate.

Great nature, great hunt, great people!!

Well organized, good guide. That's how you want it.

A perfect hunt! Excellent guiding. Amazing country. One 100% perfect!!! Best outfitter ever had in my life. Very good food. Good hunting. Thanks for experience of my life!

Many thanks, awesome time as always.

Excellent service, organization from XXX.

Good hunt, beautiful country.

Amazing amount of game, excellent outfitter, very safe and by the book.

First class hunting experience I would recommend to anyone.

Great hunting no surprises, all is good!!

The XXX family are excellent ambassadors for the NWT. They are for their clients and provide a great hunt and outdoor experience. They care for this land and its resource. I will be back to the NWT with the XXX family.

Great hunt, beautiful mountains.

Great hunt in every aspect.

Gret outfitter and mature animals.

I am 79 years old, this is probably my last sheep hunt. It is also my best sheep hunt ever.

Great experience, excellent outfitter, but very bad luck with my guide. Poor shape missed rams had trouble getting around.

Thank you so very much. This was an awesome experience!

Great hunt.

Plan to return for moose, great area, beautiful place!!

Goat fell + broke off both tips. Missed several rams + shot the wrong ram.

Great outfitter.

Very professional + treat clients very well.

One of the most beautiful areas I have ever been to. I was very impressed with the amount of responsibility the outfitter and guides assume as stewards of the wildlife and natural resource.

Everything excellent, thank you everybody, great team. We take the pleasure.

Weather warm, good clear. Good size of caribou. Ouitfitter service was everything one could expect and more.

Excellent experience, beautiful country and great guides. The time of my life.

Awesome!!!

Great experience, ample animals and nice scenery, mtns, lakes.

Lots of fun!

Great hunt, second time here. Love it here.

Also saw one lynx.

Incredible wilderness hunt, great guides, service, food, knowledge. Will definitely try to return and will highly recommend.

Very well organized, great service, great game. Highly recommend to anyone!

Very professional, by-the-book outfitter and guide. Extremely safe and responsible operation. Good people, great country.

Thoroughly enjoyed both my hunts with XXX and the XXX. They are honest, hard-working, and have a great guide area.

XXX + I did not hunt for ourselves. No hunting for XXX.

All animals looked healthy.

Very healthy bears - great berry crop.

Very aggressive sow with cubs.

Too many grizzlies within 1/2 km, need some tags, animals in good shape.

Animals in good health.

Ram was 10 years old.

Ram was a 10 yr old in good condition.

Ram was in good shape.

Too many bears, too many close encounters.

Lots of animals, good shape, good trip. Bear charged and came within 8 feet (too close)

There are too many griz running around in one valley other than that good hunt, lots of animals.

All animals appeared healthy.

All animals looked in good shape.

Really like XXX + his crew - love the quality of game + the way he spreads his hunts out so most or all places only get hunted once - Staff at Norman Wells is excellent also - (ENR) - cheers XXX. All animals looked in great shape.

All animals looked in great shape.

Good hunt, lots of game.

All animals looked in great shape.

All animals appeared to be in good shape.

All game appeared healthy.

All animals looked healthy.

Big snow storm pushed all the caribou out.

Snow storm pushed caribou north, hot weather lots of moose + griz.

Too many griz, lots of sheep, good shape.

Animals in good shape, lots of griz, tags please!!!!!

Good fun, archery hunt.

Good archery hunt

All animals looked healthy.

All animals are in good shape!

All animals are in good shape!

All animals in great shape!

All animals in great shape!

All animals appeared in great shape.

All animals looked in great shape.

All animals appeared healthy.

All animals appeared healthy.

All animals appear healthy.

All animals seem to be in good shape.

All animals appear to be in healthy shape.

All animals appeared healthy.

All animals looked healthy.

All animals looked in good health!

Moose appear healthy, lots of predators!

Brutal hunting conditions, no kills, 2-3 feet of snow.

Great experience.

Amazing guides!

Great Hunt – Excellent outfitters.

When will we be able to hunt grizzly bears?

XXX is an outstanding operation. The best hunting experience that I have ever encountered. I will definitely hunt with them again.

Great outfit, great guys.

Great hunting area - well managed.

Getting a little old, but I'd like to maybe try it again.

Very professional and knowledgeable outfit. A fantastic true wilderness experience.

Great hunt - exceptional job by outfitter and guide - thanks!

You need to start hunting the grizzly bears. Ratio of adult rams was very good, lamb survival rate was very good!

First Class!!!

Absolutely the best group of people I have ever hunted with. Very competent, helpful + friendly.

Fantastic outfitter with suberb guides + staff. The best I've ever hunted with.

Great outfitter and gorgeous country. We'll be back.

Wonderful experience. You are managing it well. Best hunting in North America. Keep up the good work!

This was our first experience with XXX and the Mackenzie Mountains. We were more than satified with our experience. We will definitely be coming back and will recommend our outfitter to anyone needing a worthwhile hunting experience.

XXX shot and killed a good old ram, but it fell into some terrible cliffs where we were unable to recover it. We spent 2 days trying.

Very some rich area - great hunting and wilderness experience. Grizzlies very numerous and aggressive - intelligent, seem to have no fear or even respect for

humans.

Hunt cut short by bad weather in Norman Wells - delayed 3 days. Game total don't include sightings from the air.

Beautiful country, lots of moose, well organized, hard working outfitter! My best hunt ever.

Excellent outfit - Great game population, self managed by outfitter with excellent discipline.

XXX hunted for 2 days + went home because of health concerns, no kills

Did not hunt

Crew member - did not hunt

Excellent experience.

Excellent experience, wonderful outfitter.

I took a wonderful dall sheep ram on this hunt. The area is spectacular and rugged. XXX have made me feel liked well loved family. My guide XXX is the best guide I have had in 30 years of hunting. She is professional, hard working, dedicated, fun and incredibly hard working. XXX and XXX are the best.

Love the blueberries!

Outfitter has a great population of game animals. He manages it well. He also takes great pains to take care of the fragile ecosystem in his area. You can see why he has such a great reputation. Great experience!!

Great hunt, great guide, lots of animals. Would definitely come back.

Excellent hunt.

Excellent hunt - great time.

Would recommend XXX to any curious hunter! Great people including guides.

Illegal ram

Best outfitter out there!! Ram 40 x 40 1/8!!!

The balance of game species of mature adult males vs females + younger animals seems healthy. I also think how the licenced outfitters have designated areas that do not overlap makes the hunting enjoyable and a true wilderness experience.

XXX are great outfitters and very knowledgeable about the game species rules + ethics of hunting and speak well of the NWT office of Environment and Natural

Resources.

Great experience. Great hunt.

Beautiful place and a top notch outfitter. Wildest place I have ever been. Would suggest to anyone to make the trip.

Too many bears.

Great outfitter/ Amazing Country!

Great experience with excellent hosts. Guide was very competent and hard working. Will plan to return.

My second trip to the area, hopefully not my last.

Everything was great.

I would like to come back with a friend + we both hunt a sheep. XXX was a excellent guide & works hard in and out of camp. I am very pleased with my bull moose.

Awesome outfitter - excellent guides, lots of sheep.

I took a tremendous ram with my bow 11.5 years old. SCI 152+.

Bad weather on goats.

Lots of nannies, no kids on 1 young billy. Lots of snow left over from past winter.

Snowed out on goat hunt.

Enjoyed entire trip. Had a few days of bad weather that were confining but overall great experience.

Missed 3 different ram's (rifle).

Mackenzie Mountains - one of my favorite places on earth to hunt.

Nice hunting ground, nice equipment, knowledgeable guides.

Everything including guides, camp facilities, number of animals seen and total outfitting was perfect.

Great hunt, very good outfitter.

XXX runs an excellent operation, with knowledgeable guides and highly organized. Hope to be back with them next year.

XXX XXX, XXX and guides were great!

We saw 2 porcupines, some beavers, squirrels, ducks, whiskey jacks (lots of them),

eagles and hawks and some seagulls.

The organization had made a fantastic job, thank you for all.

Lots of sheep, the rams seem to be in the older are group. 6 rams in my camp - average age 10-11 years. Open the grizzly season. Only hunted 2 days - saw many sheep for ground covered. Rams are in an old age class. 6 rams in camp 10-11 years old. My ram is 10.5 - also had lumpy jaw. saved lower jaw and will turn in at time of government check in.

Saw many healthy bands of sheep. Seems to be more and better quality that the last trip here 18 years ago.

Focused on Dalls sheep, excellent numbers and trophy quality, very impressed. Also lots of ewes and lambs ensuring success for future generations and demonstrating sound management.

I hunted the XXX in 1977. The country is the same as it was 35 years ago! I would start hunting grizzly bear, it is well known that high bear numbers keep moose numbers down. Thanks for providing a great hunting experience!! We saw only mature rams in excellent physically.

Beautiful country with plenty of game. Very satisfied, can't wait to return! First trip in so tough to comment. Pleased with the amount of sheep we saw and quality rams. Surprised at our bull caribou luck.

Great outfitter! Great operation with quality game. XXX went above and beyond all expecations to put on a great hunt. Quality all the way around. Game is plentiful. Great quality of game harvested and great quality of other animals scouted. Fabulous outfitter and operation ran.

Wonderful time, beautiful country. This country is a 10!

I am an outfitter for XXX + I love it! Best country ever.

First year guiding was so excited to be able to hunt for myself. 98 pounds of meat was taken by a bear on Aug 8th, 2012. Great country, lots of game.

Excellent outfitter, safety and professionalism were consistent throughout the hunt. Great quality sheep and caribou abundant.

There are way too many grizzly bears in the geographic area that I was hunting in. I think it is time that a grizzly bear hunt to be instituted. An overall amazing experience I think I got to see just about every species of animals here! My first encounter with grizzly bears. I think there are too many grizzlies for the area I was in. I think that there should be a hunt for the grizzly bears. What an amazing experience, would love to

come back!

XXX "XXX & XXX" were al first class. A great experience, great food. "Got my grandslam" I have never seen such organized people. The whole camp puts everything they got into helping you have a great trip. The area is great, the game is plentiful. They all look very healthy + in great numbers.

Lots of game, great area. Excellent Dall's sheep in area.

The territory is beautiful - I had a wonderful experience with XXX and I plan to return. The game was plentiful - I think there should be hunting for grizzly bears.

The quantity and quality of wildlife observed was excellent! All animals observed appeared healthy and the age distribution was good... Many animals seen in all the age classes. Many caribou + sheep... also observed what I considered a high number of mature grizzlies.

I hunted 2 out of 100 days for myself. I guided the other 98 and it was another great year. Everything appears healthy and numerous, especially the damn bears.

Excellent trip! Numbers and condition are just fine.

Hunting was supperb. Country is beautiful and should remain as is.

Really good experience. Quantity was fair, condition was good.

We had a tough but great hunt that had everything come together the last day. Beautiful area, great, great outfitter! Had a tough hunt until the snow melted - then we started to see animals.

Had a good hunt considering the weather (snow).

Beautiful country. No observations of unusual conditions/behaviours.

Not as many caribou as heard from previous years, therefore, less to compare with & harder hunting.

Good people + excellent outfitter. Numbers seemed low, but quality was good.

Especially enjoyed the horses. Caribou seemed to be moving on last few days.

Very nice - they work very hard, kept a good attitude. The quality of animals "mtn caribou" was nice - do to weather I suspect the quanity was lower than expected.

Lots of caribou/sheep, beautiful country and great camp. Lots of caribou, good bull/cow ratio... I saw no wolves of bears, but did see their scat. My bull caribou was in great shape, but not much body fat.

I am very satisfied with my hunting experience. I am very happy with the condition and

quality and quantity.

Plan on returning for Dall's sheep. Quality of caribou very good, condition of animals good, quanity of caribou fair.

Timing was off for caribou moving. Green grass, 2 feet of snow hampered the hunt.

Because of the early snow in September, the quantity and quality of game was poor. They weren't here. The ones we did see were smaller and mostly cows/calves. I heard it was great last year!

Very good hunt, excellent people to hunt with and made some life long friends. Animals observed look very good.

My hunt was a very good experience, and the food was very good. The living quarters was very good also. The (cook) was bossie in her kitchen, just like my wife. The quality of the wildlife was very good.

Great people, helicopter cost extremely high. Lots of moose, caribou none where I was.

My moose was small with no scars, body big, small antler compared to others in group.

Open grizzly bear hunts.

Weather ruined hunt, need to book more than 4 days hunting.

Great outfitter + guides. Exceptional stock, good accomodations + great food, true wilderness experience. I encourage the NWT Government to open hunting of grizzly bear. I found the sheep hunting to be excellent once again. Good #'s of sheep in all age class + good lamb recruitment. I could have taken a ram but held out for larger ram.

Good sheep numbers with most of the ewes having lambs, we noticed that many of the caribou cows did not have calves. Lots of wolf sign in most areas.

Was unable to travel very far, therefore the numbers seen were few.

APPENDIX D

A summary of the 2012 voluntary hunter comments broken down into specific topics.

No. of hunters reporting	No. of hunters mentioning good quality hunts	No. of hunters mentioning abundance /quality of animals	No. of hunters mentioning grizzlies	No. of hunters mentioning wolves	No. of hunters mentioning Park expansion	No. of hunters mentioning bad weather
200	112	80	23	3	0	15

APPENDIX E

Number, age, and horn length measurements of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1967-2012. Number harvested includes 10[1], 2[2], 6[3], 8[4], 7[5], 9[6], 4[7] and 11[8] harvested by resident hunters.

Year	Number of Sheep Harvested	Age (Years)		Length of Right Horn	
		Mean	Sample Size	Mean (cm)	Sample Size
1967-1968	223	8.4	Unknown	86.4	168
1969	110	-	-	-	-
1970	94	-	-	-	-
1971	88	-	-	-	-
1972	110	8.5	96	86.2	90
1973	89	8.9	86	84.4	88
1974	93	9.2	85	88.6	91
1975	129	7.6	67	84.6	127
1976	144	7.8	46	88.0	144
1977	132	5.7	69	86.8	132
1978	187	8.5	115	88.9	165
1979	200	8.7	108	90.8	154
1980	188	-	-	90.1	127
1981	183	8.1	101	92.7	157
1982	126	8.7	98	89.7	124
1983	100	9.0	80	90.9	94
1984	102	8.4	98	91.2	99
1985	123	8.1	115	89.7	112
1986	154	8.8	132	88.4	153
1987	148	8.9	148	89.4	148
1988	177	9.8	166	91.7	161
1989	207	9.9	199	90.4	203
1990	219	9.8	200	90.2	218
1991	170	9.7	161	89.1	170

APPENDIX E (CONT.)

Number, age, and horn length measurements of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1967-2012. Number harvested includes 10[1], 2[2], 6[3], 8[4], 7[5], 9[6], 4[7] and 11[8] harvested by resident hunters.

Year	Number of Sheep Harvested	Age (Years)		Length of Right Horn	
		Mean	Sample Size	Mean	Sample Size
1992	203	9.7	199	88.0	202
1993	191	9.7	181	87.6	190
1994	199	9.5	191	89.8	196
1995	189	9.6	189	88.9	189
1996	201	9.5	200	88.7	201
1997	210	10.0	206	89.9	203
1998	215	10.0	207	90.0	209
1999	204	10.2	183	88.8	184
2000	194	10.0	188	88.9	188
2001	199	10.1	183	87.7	184
2002	173 [6]	9.9	166	89.2	166
2003	213 [3]	9.7	210	89.8	212
2004	201 [1]	10.0	199	89.3	200
2005	203 [7]	10.2	196	89.4	199
2006	208 [8]	10.4	206	88.4	207
2007	216 [3]	10.8	216	88.3	216
2008	192 [4]	10.6	192	88.8	192
2009	179 [5]	10.9	178	88.2	178
2010	193 [6]	10.8	191	88.7	192
2011	181 [7]	10.8	181	90.5	181
2012	207 [6]	10.9	205	89.9	206
Mean 1972-2012	**174**	**9.4**	**156**	**89.0**	**167**

APPENDIX F

Outfitted non-resident hunter harvests in the Mackenzie Mountains, 1991-2012. Number harvested includes 10[1], 2[2], 6[3], 8[4], 7[5], 9[6], 4[7] and 11[8] harvested by resident hunters.

Year	Number of Licences Sold	Number of Animals Harvested						
		Dall's Sheep	Mountain Caribou	Moose	Mountain Goat	Wolf	Wolverine	Black Bear
1991	354	170	179	40	6	14	3	1
1992	364	203	142	32	4	7	0	0
1993	382	191	191	56	9	7	3	0
1994	356	199	164	46	5	15	2	0
1995	344	189	180	49	6	14	1	0
1996	387	201	175	46	4	9	4	0
1997	352	210	168	44	2	17	1	0
1998	345	215	160	52	5	9	0	0
1999	321	204	117	36	1	11	3	0
2000	332	194	127	44	1	14	0	0
2001	332	199	128	41	2	15	2	0
2002	338	173[6]	168	42	5	11	1	0
2003	350	213[3]	143	48	6	12	0	0
2004	347	201[1]	135	55	6	18	0	0
2005	398	203[7]	160	75	18	19	1	0
2006	418	208[8]	188	72	12	23	1	0
2007	405	216[3]	165	74	21	12	0	0
2008	399	192[4]	167	75	21	17	1	2
2009	339	179[5]	125	59	20	20	3	1
2010	384	193[6]	158	75	13	19	3	0
2011	400	181[7]	181	78	20	21	2	1
2012	405	207[6]	168	85	12	24	0	0
Mean 1991-2012	**366**	**197**	**159**	**56**	**9**	**15**	**1**	**0**

APPENDIX G

Summary of age and sex ratios calculated from non-resident hunter observation reports in the Mackenzie Mountains, 1995-2012.

Year	Dall's Sheep		Mountain Caribou		Moose	
	Lambs: 100 Ewes	Rams: 100 Ewes	Calves: 100 Cows	Bulls: 100 Cows	Calves: 100 Cows	Bulls: 100 Cows
1995	67	82	36	34	30	95
1996	44	82	45	40	26	76
1997	57	55	36	21	30	107
1998	60	84	35	34	30	95
1999	58	90	43	25	20	100
2000	47	90	41	39	26	89
2001	59	89	56	61	28	120
2002	58	89	59	31	29	96
2003	50	83	39	36	25	129
2004	53	93	42	38	30	101
2005	51	98	42	42	33	110
2006	53	96	43	37	33	137
2007	64	83	52	37	36	101
2008	49	98	41	40	31	115
2009	55	94	45	39	31	90
2010	49	93	45	46	35	101
2011	56	91	44	35	33	123
2012	53	86	40	46	33	88
Mean 1995-2012	**55**	**88**	**44**	**38**	**30**	**104**

APPENDIX H

Summary of age and sex ratios calculated from non-resident hunter observation reports of mountain goats, 2002-2012.

Year	Kids:100 Nannies	Billies:100 Nannies	Total Animals
2002	55.2	75.9	69
2003	61.5	70.5	182
2004	57.1	77.1	84
2005	66.0	50.4	306
2006	61.5	51.4	245
2007	71.2	57.7	393
2008	54.3	97.1	264
2009	64.6	59.0	327
2010	78.3	46.2	239
2011	64.0	59.0	243
2012	51.8	71.9	257
Mean	**62.3**	**65.1**	**237.2**